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Contents

	PAGE
EDITORIAL NOTES: Dyestuffs Distribution; The Future of the Häusser Process; The Club's Future; Treatment of Caustic Sludge; \$25,000 prize for Chemists.....	405
CORRESPONDENCE: Professor Lowry, Dr. E. A. Armstrong, "Student," and "Chemical Merchant".....	408
The Christie Vibratory Process.....	409
Oxidation of Aromatic and Aliphatic Hydrocarbons.....	410
Disposal of Waste Organic Matter.....	412
British Association: Papers on "The Nitrogen Industry" ..	414
Reclaimed Rubber: Paper by Dr. Torrey.....	419
From Week to Week.....	420
References to Current Literature.....	421
Patent Literature.....	422
London and Scottish Market Reports.....	425
Commercial Intelligence.....	430

NOTICES :—All communications relating to editorial matter should be addressed to the Editor, who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Communications relating to advertisements or general matters should be addressed to the Manager.

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Dyestuffs Distribution

NOTHING has been published during the week to throw much additional light on the transfer of the work of distributing German Reparation dyestuffs from the Central Importing Agency to the British Dyestuffs Corporation. The account we were able to give last week, however, appears to describe the situation fairly accurately. In this matter the Corporation will be as purely a distributing agency as the Central Importing Agency was, with, however, a more intimate knowledge of the business, an improvement in facilities to the trade, and—so we are informed—more favourable terms to the Government and to users. The Colour Users' Association has not yet pronounced any definite opinion on the change, but some of the personal statements by members reveal no very decided objection so far. The point to be remembered is that some body must be responsible for doing the work. The traders, with whose difficulties everyone will sympathise, criticised the old arrangement. They criticise the new. If the Board of Trade, instead of appointing the Dyestuffs Corporation to act as its agents, had selected some well-known firm of chemical merchants for the purpose, would the remaining firms have accepted the arrangement without demur? It seems

to us that any selection of an individual firm or corporation would be equally open to criticism from its competitors in the trade. The alternative is some joint body; but committees are notoriously dilatory in work, and in any case the merchant community, until it can speak with an undivided voice which will be accepted as representative of its collective interests, must remain at a disadvantage as compared with the well-organised manufacturing interests.

The Future of the Häusser Process

THE paper dealing with the Häusser process which Mr. C. J. Goodwin contributed to the discussion on "The Nitrogen Industry" at the British Association is certainly opportune, if only for the fact that for the past few years this process has received comparatively little attention as a commercial proposition. There have, in fact, from the point of view of nitric acid manufacture, been other and more attractive alternatives; and, ingenious as Häusser's method is from the technical standpoint, the power which he throws to waste is a consideration almost sufficient to break the heart of anyone with an engineering mind or of the gas manufacturer who places a high value on the potential energy of his commodity. The Häusser process, we fear, must remain a little weak in its appeal to the technical and commercial sense so long as it involves the waste of valuable thermal energy merely in order to obtain a chemical product which admittedly can be obtained more cheaply by other means. Another objection which was commonly raised some few years back was the enormous capacity of the absorption towers required; but this seems to be a defect which has recently been overcome by effecting oxidation under pressure. In fact, Mr. Goodwin furnishes the encouraging information that the amount of oxidation space required in the absorption tower system can, by operating under pressure, be reduced to about $1\frac{1}{2}$ per cent. of that required at atmospheric pressure. This, indeed, is a notable advance, and should in itself stimulate those who are interested in the process to continue their endeavours to find a practical solution of the problem of utilising the power derived from the explosion of gas. Mr. Goodwin has obviously a predilection for coke-oven gas as his raw material; and from both the technical and commercial points of view this gas is certainly to be preferred to, say, producer gas, for it has a comparatively high calorific power and is frequently a surplus product. The richer the gas mixture the higher is the resulting temperature, and it has been shown that if coke-oven gas is exploded with air under the most favourable conditions the theoretical concentration of nitric acid should reach a maximum of 0.865 per cent.

In recalling the possibilities of the Häusser process, one's mind naturally goes back to the very thorough investigation which Mr. H. A. Humphrey conducted in 1917. Mr. Humphrey's painstaking analysis of the conditions arising, his exposition of the defects of the system, and his ingenious suggestions for utilising the power from explosion form perhaps some of the most complete literature on the subject, and it would be most instructive to learn whether the almost valveless contrivance which he suggested was ever developed further. There seems to be no question now that to utilise the power of explosion in a gas engine would be more or less hopeless in actual practice, for, apart from its special design, the engine would be subjected to shocks and unusual stresses and would necessitate the movement of the piston on a time basis. Mr. Humphrey pointed out, however, that it should be quite possible to devise a simple form of apparatus which would better fulfil the purpose of utilising the power, at the same time doing away with all trouble with valves, and further to ensure that the explosion chamber was filled with a measured volume of properly proportioned mixture for each cycle. The future of the Häusser process would seem to depend upon the evolution of a power-consuming machine of the kind.

The Club's Future

THE discussion which Dr. Stephen Miall opened at the Chemical Industry Club on Monday on the future of the institution is stated to have produced some useful suggestions. It fell, however, under the ban of the censorship authorities, and must be treated with as strict a privacy as if it were a meeting of a masonic lodge or a Cabinet session discussing some momentous move in European politics. It is not quite clear who has imposed this rule, but in our opinion it is bad for the Club's own interests from at least two points of view. Recently a member who travels much in the North told us that he made a point of mentioning the Club to friends who might be desirable members, but generally found that they knew nothing about it. Nor is the present policy likely to inform them, because it restricts the interest to the existing members and correspondingly limits the appeal to outsiders. Moreover, it looks, to people familiar with the spirit of public work, a little childish. The truth is that men whose opinions are worth publishing rarely trouble about whether they are reported or not, or in any case have sufficient judgment to know what to leave unsaid. The people who suffer most from the sweats and fears of publicity are those generally whose opinions attract least notice and would, in any case, produce no revolutionary effect on anybody.

The subject of the Club's future is, however, being discussed a good deal outside its walls, and a few points may be worth noting. The Club has been up to now a real success. It pays its way; it has been well managed; it has hitherto been run solely for the convenience of the members by those the members themselves elect, without interference or influence from outside; its atmosphere is free and clublike; it provides a common meeting-ground such as no other society supplies; and its membership, if smaller than it might be, is united, contented, and free from divisions.

These are by no means negligible results to have attained on so small a subscription. But about the fifth year every institution has to decide whether it is to go forward or go back. That stage seems to have been reached in the present case, and efforts are being planned for expansion. If they are on right lines a great success may result; if on wrong lines the structure already built up may be brought down. Some conditions seem to us essential for a successful club. Its membership should be as comprehensive and its management as free and democratic as possible. Once the interests of the members have to be accommodated to outside influences this freedom disappears, and with it much of the Club's vitality. Again, if the club ceases to be entirely self-supporting, its independence may be affected, and that might prove a fatal loss. It may be found possible to secure the advantages aimed at without sacrificing any of the essential elements in the present management, but to reap the expected gains and avoid the possible losses may require a little statesmanship. Sound and sure leadership with a moderate breadth and distance of vision, rather than fussy diplomatic activity revolving in a circle, seems the need of the moment.

Treatment of Caustic Sludge

ATTENTION may be usefully drawn to an account, published on another page, of the Christie vibratory process, by which—taking one case as typical—caustic sludge may be reduced to a dry finely-divided carbonate of lime, capable of even distribution over farm land, and sufficiently fine to be distributed mechanically. The process, which has been acquired by Ernest Scott and Son (London), Ltd., may have an appreciable influence on the chemical industry by bringing into a controllable form plastic materials which are too thick to be pumped, and so cohesive on the other hand that they present great difficulties to conveyors and elevators. In the notice referred to, the application of the process to the treatment of waste lime from causticising plants is described, and as the firm have installed something like 600 of these plants throughout the country in various trades they may be presumed to know something of the trouble this waste material presents. Although there has always been a market for a dry powder lime, it has had to compete with natural chalk, and the moment the costs exceed a certain point the natural product, even though brought from a distance, secures a market. Now, it is stated, this waste material can be brought into a mechanical state superior to ordinary quarried chalk. Hitherto the difficulties of control, in the handling from the source of production to the drying apparatus, has constituted a serious item with labour costs what they are, or it has sometimes been necessary to send the material forward with so much moisture in it that the fuel bill has turned the balance against it, and again, on arrival at the drier, it has not been in a condition to secure the best results there. If these difficulties have been overcome the advantages are obvious, and we are informed that the process, which has been working for a year or so, presents a satisfactory solution of them. The question is of considerable interest to agriculture in view of the British farmer's much too restricted use of lime products on certain soils.

A \$25,000 Prize for Chemists

WE have more than once expressed the opinion that public societies which have the courage to work single-mindedly for the public good and have sufficient faith in their mission to give a secondary place to mere ways and means, are never left to die for want of funds, whereas those which substitute the means for the end and make self-preservation their chief if not their sole aim, deserve the fate they generally get. An example of this is supplied by the generous offer which the chairman of the Allied Chemical and Dye Corporation of New York has just made to the American Chemical Society to institute an annual prize of \$25,000 "to reward the chemist, residing in the United States, who in the opinion of a properly constituted jury has contributed most to the benefit of the science and of the world." In communicating this offer the chairman of the Corporation writes: "Realising, as we do, the enormous influence which chemists working in all the fields of that science will have on the welfare of the world, we desire by this prize so to encourage the workers that even larger benefits should accrue than those which have already placed the world under such a debt of gratitude to the profession. We do not desire to limit the gift to any particular field of chemistry, recognising, as we do, the importance of them all. As the American Chemical Society is by far the largest organisation of chemists and represents every field of the science in its membership, we have thought it better to work through that Society, although not limiting the gift to its members. Our sole desire is to encourage chemists everywhere in our country to do even more than they have been doing for the general good." The prize, we understand, will be in the nature of the Nobel prizes for achievements in literature and the sciences, and the American Society, while appreciating the mark of confidence such a gift implies, hope that it may have a most stimulating effect on chemical research and enterprise.

Another announcement of considerable interest is made by the American Society, namely, that the *Journal of Physical Chemistry* is for the future to be published under the joint auspices of the American Chemical Society, the Chemical Society of London, and the Faraday Society of Great Britain. This arrangement is understood to be the result of the recent visit of Dr. Charles L. Parsons, secretary of the American Chemical Society, to England, and his conferences with the parties interested in the proposed internationalisation of this important publication. The control of the *Journal* will be vested in a joint board, and Mr. F. P. Garvan, President of the Chemical Foundation, has guaranteed \$10,000 annually for five years towards the cost of publication. In these ways, in the United States, are faith and public-spirited work rewarded.

White Lead

THE Government has, we understand, taken preliminary steps towards the application of the Draft Convention on the use of white lead in painting which was adopted by the International Labour Conference last year. The main purposes of the Convention are to prohibit

after November 19, 1927, the use of white lead in the internal painting of buildings, except (under agreed conditions) railway stations and industrial establishments, and, where white lead is not prohibited, to make its use subject to precautionary hygienic regulations as from January 1, 1924, and to make cases of lead poisoning compulsorily notifiable.

In preparation for the application of these provisions in Great Britain, the Home Office recently invited the Painters' and Decorators' Industrial Joint Council of Great Britain, representing the National Federation of Master Painters and Decorators of England and Wales, the National Operative Painters' Society, the Scottish Painters' Society, and the National Federation of Master Painters in Scotland, to meet representatives of the Home Office in order to discuss the drafting of regulations. As a result of three such meetings, draft regulations have been adopted, together with a resolution urging the Government to give legal effect to these regulations at the earliest possible moment.

Points from Our News Pages

- Letters are published from Professor Lowry (Cambridge), Dr. E. A. Armstrong, "Student," and "Chemical Merchant" (p. 408).
- The Christie vibratory process for the disposal of caustic sludge is described (p. 409).
- The oxidation of aromatic and aliphatic hydrocarbons is discussed by a technical writer (p. 410).
- Particulars are given of the Birmingham scheme for the bacteriological disposal of waste organic matter (p. 412).
- The concluding report of the British Association proceedings includes papers by Mr. J. H. West, Mr. C. J. Goodwin, and Dr. E. B. Maxted on "The nitrogen industry" (p. 414).
- The chemical trade during the current week, according to our London Market Report, has been quietly steady without any outstanding feature (p. 425).
- Our Scottish Market Report indicates no material change (p. 427).

Books Received

- MARINE INSURANCE FOR THE SHIPPER. By Joshua Lea. Manchester: The Manchester Guardian, Ltd. Pp. 101. 1s.
- THE CHEMISTRY AND TECHNOLOGY OF GELATIN AND GLUE. By Robert Herman Bogue. London and New York: McGraw-Hill Book Co. Pp. 644. 30s.
- THE BRITISH GLASS INDUSTRY: ITS DEVELOPMENT AND OUTLOOK. By W. E. S. Turner. Sheffield: The University, Department of Glass Technology. Pp. 40.

The Calendar

Oct.		
9-15	International Congress on Liquid Fuels.	Paris
11	Paint and Varnish Institute: Inaugural dinner	London.
13	Society of Chemical Industry: Annual London Dinner. 7 p.m.	Connaught Rooms, Great Queen Street, Kingsway, W.C.2.
14	The Mining Institute of Scotland: General meeting.	Edinburgh.
16	Institution of Rubber Industry	Midland Hotel, Manchester.
23	Institute of Chemistry (Huddersfield Section): "The present position and future prospects of the Institute and the Profession." The Registrar of the Institute.	Huddersfield.

Professor Lowry on the Ionic Theory

To the Editor of THE CHEMICAL AGE.

SIR,—As your amiable correspondent* has seen fit to bring in my name as a supporter of the theory of ions, it is perhaps appropriate that I should add one or two comments to his discourse. It may be only of personal interest to say that it was the neatness of the theory of ions that first attracted me as a schoolboy to the profession of chemistry, and led me to become a pupil of the foremost opponent of that theory, whom I gladly recognise as having more claim than anyone I know to the title of "The Compleat Chymist," under which your correspondent so thinly disguises him. I then found by experience that whilst it was unsafe to speak to my chief about the "degree of dissociation" of a salt which might not have dissociated at all, it was perfectly safe to argue about the "coefficient of ionisation" of a salt as the ratio of two experimentally determined conductances. I accept the theory of ions as affording the only plausible interpretation of that ratio, since none of the alternative hypotheses have assumed a similar quantitative form, or even given a semi-quantitative explanation of Van't Hoff's well-known "i" factor.

The fundamental difficulty of the ionic hypothesis has always been to find a source of energy which would account, not merely for the pulling apart of the atoms of sodium and chlorine in a molecule of sodium chloride, but also for the additional work involved in separating the atoms when endowed with electrical charges of opposite sign. Some years ago Mr. Bousfield and I found that it was possible to calculate the work that must be done in order to overcome these electrical forces, by assuming that Stokes's Law of viscous resistance, and the formula for the relation between the capacity and radius of a spherical condenser, could be applied to the ions; the results showed that only in a medium of high dielectric capacity was this work small enough to be comparable with the heat-evolution in ordinary chemical changes. The only obvious source of energy that was available to overcome this electrical attraction was the mutual affinity between the ions and the solvent. In this connection it may be recalled that the first interpretation which Arrhenius gave of the increasing conductance of a salt on dilution included the progressive hydration of the salt, and that the subsequent insistence of the anhydrous quality of the "naked ion" was primarily a German conception; unlike the combatants of 30 years ago, I have always felt that the hydrate theory and the theory of ions were complementary rather than antagonistic, and I have consistently urged that hydration alone was capable of explaining the ionisation of aqueous electrolytes.

At the present time I think we can go a good deal farther in the direction of accounting for ionisation than we could a few years ago. I doubt if the average chemist has realised how completely his science has been revolutionised by the octet theory of Lewis. It is, perhaps, not speaking too strongly to assert that chemical affinity in all its bewildering ramifications may find its ultimate explanation in the mysterious forces which appear to operate in favour of the formation of complete octets of electrons, or, more generally, of complete shells of 2, 8, 18, or 32 electrons. Ten years ago we were obliged to assume that it would be even more difficult to produce oppositely charged ions of sodium and chlorine than it would be to drag apart the two neutral atoms in a molecule of salt; at the present time, however, it appears probable that the forces involved in octet formation are so powerful that the electrification of the atoms, by the transference of the spare electron of sodium to the incomplete octet of chlorine, may actually be the principal factor in determining the affinity of these

two elements for one another. Under these conditions the manufacture of ions from atoms would be an exothermic instead of an endothermic process; but their separation from one another would still be endothermic, requiring the expenditure of energy of hydration on the scale calculated by Mr. Bousfield.—Yours, etc.,

T. M. LOWRY.

The Chemical Laboratory,
The University, Cambridge.
September 16, 1922.

A Correction by Dr. Armstrong

To the Editor of THE CHEMICAL AGE.

SIR,—In your necessarily condensed account of the remarks I made before the British Association you attribute to me a remark which, divorced from its context, makes me appear discourteous to a valued colleague, and I hasten to correct this false impression.

In alluding in a jocular manner to the large bulk of literature relating to hydrogenation, which is very completely abstracted by Carlton Ellis in his well-known book, I declared this literature to be full of inaccuracies and loose statements, thereby in no way holding Mr. Ellis responsible for these. Indeed, I would take this opportunity of testifying to the great value of his book to all workers in this field.

It remains unfortunately a fact, which I for one see no means of altering, that any book on a technical subject, based on published patent and other literature which is necessarily in the main an abstract, must contain many misleading statements.—Yours, etc.,

E. A. ARMSTRONG.

Greenbank, Latchford, Warrington.
September 18, 1922.

The Messel Memorial Lecture

To the Editor of THE CHEMICAL AGE

SIR,—Perhaps some of your correspondents can explain a point which rather puzzles me. I have only an elementary knowledge of chemistry and cannot quite get to the bottom of some of the statements in the Messel Memorial Lecture which I have recently read. It is as to the nature of acids, and the books I have referred to do not help me very much.

In *Van't Hoff's Lectures*, Vol. III., on page 115, are sentences which seem to imply that hydroxyl is responsible for the acid properties of organic acids, and on page 120 I find the following:—"Oxygen intensifies acidity. No element possesses this property in so high a degree as oxygen, which indeed owes its name to the favouring influence it exerts on the introduction of metal. In inorganic chemistry the instances are so common that there is no need to quote any" etc. In Moureu's *Organic Chemistry*, page 230: "We shall apply the name of acid proper only to such compounds as are derived from aldehydes by the simple addition of oxygen."

But on the other hand in Norris and Mark's *Laboratory Exercises*, page 194: "By no type of reaction previously studied could the facts be so well explained as by the assumption that every acid in solution breaks up into two electrically charged substances, one of which is always hydrogen, and that this is the substance which gives the similar properties to all acid solutions." Holleman's *Text Book of Inorganic Chemistry*, page 101, says: "Acids are those substances which give H-ions in aqueous solutions."

Ought I to adhere to the side of Van't Hoff, Armstrong, and Moureu or to Norris and Mark and Holleman? Perhaps Professor Findlay can advise me. "Dr. Lagueur" and "A Spagirist" both write in so archaic a style I am afraid they may not be up-to-date.

* Am I not correct in picturing him as enveloped with the halo of the earliest Christian martyr?

I am not sure the statements quoted above are quite inconsistent. It may be that oxygen is responsible for the acid properties and that it makes use of this power to eject a hydrogen ion, and that this ion is a test of the presence of an acid rather than the cause of the acid properties.—Yours, etc.,

STUDENT.

September 16, 1922.

Merchants and Reparation Dyestuffs

To the Editor of THE CHEMICAL AGE.

SIR,—Merchants engaged in the chemical trade will read with interest the letter of Mr. F. T. T. Reynolds relating to the difficulties under which we are trying to carry on business, but I fear it is true, as you say in your editorial note, that instead of accepting the new conditions and making the best of them we are simply hoping for a return to pre-war conditions that is not likely to come about for some years. The country has given a definite pledge to the dyestuffs industry to be protected from unrestricted German competition for a period of years, and merchants, like every other class of the community, must respect that pledge and not try to treat it as "a scrap of paper." It is not much use continually to criticise without putting forward alternative proposals.

Another difficulty is that the merchants are not united and have no single representative organisation for protecting their interests and voicing their opinions. They have little or no sense of collective action in their common interests, and so long as we all regard one another with suspicion and are so nervous about giving our so-called secrets away to competitors there is not much hope of improvement in this respect. The manufacturers have learned what can be done by co-operation; the merchants have yet to learn the lesson.—Yours, etc.,

A CHEMICAL MERCHANT.

September 19.

Disposal of Caustic Sludge

Notes on the Christie Vibratory Process

THE handling of waste lime sludge has long proved one of the chief difficulties of the manufacturer making caustic soda for his own requirements. The days have passed when this waste could be flushed with impunity into rivers and drains. Convenient tips are disappearing, and in any case are costly, while the cartage of the consolidated sludge is alone a heavy expense, and brings penalties for road fouling by the unsightly drip from the vehicles, a cause which is fast bringing the railway companies to refuse the freight altogether. The obvious remedy is to dry the material and dispose of it to manufacturers in other industries or to agriculture. This, however, also has its grave difficulties on account of the nature of the material, even when consolidated as far as possible in stationary or rotary vacuum filters. It is obviously necessary, for fuel economy, to reduce the water contents to the limit, but under the best conditions there remains 45 to 50 per cent. of water.

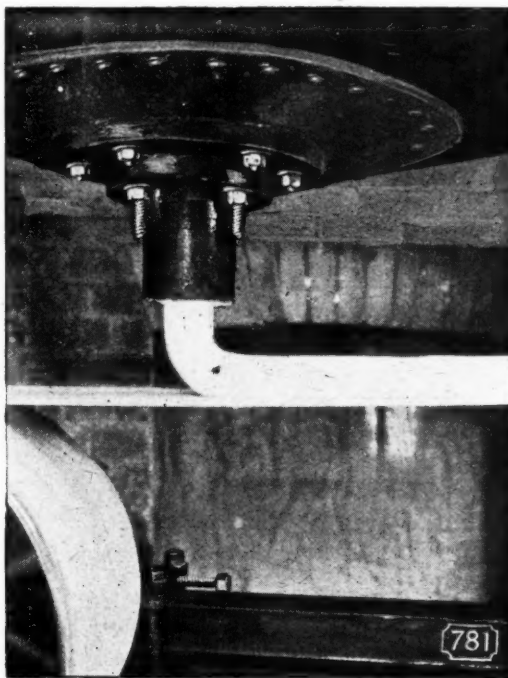
In this state the material has a stubborn consistency that introduces trouble in any form of conveyor, and only allows the material to enter any of the convenient forms of driers in lumps of a size so uneven as to render the economic control of the drier almost impossible. The tendency to "ball" the charge further intensifies this difficulty.

A recent invention of an extremely interesting, but nevertheless simple character promises, as the result of extended experience, to eliminate these troubles, and to convert a nuisance waste product into a valuable commodity. Confronted with these difficulties Mr. H. W. Christie of The United Turkey Red Company, together with his staff, devised a successful process and apparatus which has now been working some time in their works, and for which patents have been granted in this and several other countries. They discovered that when this caustic sludge (as well as other similar materials) is subjected to vibratory influence it has the remarkable effect of

converting this stubborn clay-like material into a viscous fluid without in any way increasing the water contents.

In application, the sludge, de-hydrated as far as possible by vacuum filters, is discharged into a large receiver equipped with the apparatus required to operate the patent, this apparatus being of a surprisingly simple character and absorbing little more than $\frac{1}{2}$ h.p. for an output of one ton per hour. Under the influence of the vibratory treatment the sludge flows from the orifice of the receiver in a continuous cylindrical tenacious stream, the character of which may be judged from the photograph illustrated. On leaving the orifice it is picked up by a simple belt conveyor on which it lies, still maintaining its formation, and in this way it is directed straight into the cylindrical rotating drier.

As an indication of the nature of the action, it is instructive to observe that though the receiving vessel has a permanently open discharge, if the vibrator be temporarily stopped, the flow immediately ceases.



It is also interesting to note that even after entering the drier, and during its progress through that machine, it still maintains its form and pipe-like shape, until the drying causes complete disintegration. This is of the greatest importance in view of the tendency of this and similar materials to ball up, thus presenting the worst possible conditions for rapid and even drying.

The practical outcome of the application of this invention has taken the form of placing on the market a dry, evenly powdered carbonate of lime in a form which makes it not only acceptable to the farmer for even distribution on the land, which is important, but allows the use of mechanical distributors. One of the chief objections hitherto shown by the farmer to the use of this sludge has been its uneven character, and the difficulty of applying it with certainty to the soil in the proportions required.

The purely local demand is now in excess of the supply, and it opens up a field for the development of this waste product which should solve once and for all the difficulty of disposal in other parts of the country.

The process is known as the "Christie Patent Vibratory Process," and its development has been placed in the hands of Ernest Scott and Company, Ltd., the chemical engineers whose caustic soda plants are so widely distributed throughout the various industries, and it should thus stand every chance of successful exploitation. Those interested are invited to write to this firm, either at Kingsway House, Kingsway, London, W.C.2, or at 19, Waterloo Street, Glasgow.

The Oxidation of Aromatic and Aliphatic Hydrocarbons

Our contributor deals with the partial oxidation of certain hydrocarbons and indicates the influence which such processes are likely to have on both the fine and general chemical industries. In particular, attention is drawn to the promise held out by methods whereby a low-value mineral oil may be transformed into a series of far more valuable oxidation products.

THE outstanding triumphs of applied catalysis as exemplified, for instance, in the hydrogenation of unsaturated glycerides and of nitrogen (synthetic ammonia), and in the oxidation of sulphur dioxide to the trioxide and of ammonia to oxides of nitrogen, have naturally had very considerable attention in general chemical literature. Other catalytic oxidation processes which are extensively practised in industry are the oxidation of acetaldehyde to acetic acid, the oxidation of sulphuretted hydrogen to free sulphur in the process of coal-gas purification, the oxidation and polymerisation of oils in the linoleum and paint industries, and so forth. There are, in addition, several newer catalytic oxidation processes, the importance of which has not been completely realised as yet, and which it may be well to indicate. It is proposed to describe shortly the processes of partial oxidation of hydrocarbons, both aromatic and aliphatic, since many products valuable in the fine chemical and in general industry may be obtained.

Thus the carefully controlled partial oxidation of benzene will lead to the production of maleic and fumaric acids, which are of great potential value in synthetic organic processes, as well as of proven value in the dyeing of fabrics. Similarly, the catalytic partial oxidation of toluene provides an excellent method for the practical formation of benzaldehyde and benzoic acid. Naphthalene, again, yields phthalic anhydride, in a manner much more satisfactory than by the older processes using sulphuric acid and a mercury or mixed mercury catalyst.

Turning to a consideration of the oxidation of aliphatic hydrocarbons, it will be shortly shown that aldehyde fatty acids, aldehydes, and other oxidised products can be produced, which may find application in the paint trade, as fuels for internal combustion engines, as lubricants, and as froth flotation oils. The low-value original mineral oil is transformed into much more valuable products.

Benzene Oxidation

The products of the complete oxidation or burning of benzene are, of course, carbon dioxide and water, but it is possible by a careful regulation of conditions to obtain products of incomplete oxidation. Such substances as maleic acid, quinone, etc., can be isolated, and, with the use of a suitable catalyst, technical scale production can be assured. It has been stated that the function of the catalyst is to widen the range of temperature in which the products of incomplete oxidation of benzene are stable, and thus allow of their isolation in good yield.

In outline, the process of partial oxidation of benzene is carried out by passing a mixture of benzene vapour and air over a catalyst, originally heated to a predetermined temperature, say, 300° C. The oxidation is naturally exothermic in character; and the greatest difficulty in operation is to maintain the optimum temperature and to prevent excessive rise, whereby further oxidation and complete destruction of the benzene is induced. The extent of the temperature rise possible, and the difficulty attendant upon temperature control, can be assessed by comparison with other oxidation processes. Thus, whilst the catalytic oxidation of sulphur dioxide to the trioxide liberates 635.6 B.Th.U. per lb. of gas oxidised, and the oxidation of ammonia for the production of nitric acid causes the evolution of 5,660 B.Th.U. per lb., the oxidation of benzene to maleic acid involves the liberation of no less than 10,560 B.Th.U. per lb. (Weiss and Downs, *J. Ind. Eng. Chem.*, 1920, p. 220). Moreover, in the case of the first two oxidation processes the heat capacities of the gaseous products are slightly greater than the total heat evolved. In the oxidation of benzene to maleic acid, on the other hand, the heat capacity of the products is only one-sixth of the heat evolved. The importance of temperature control is thus apparent, and is further demonstrated in the following descriptions of apparatus which has been adopted by the Barrett Co. of America for the practical operation of the process.

In English Patent No. 167,219, for instance, the reaction chamber contains a number of perforated trays, supporting the catalyst. Above and below each catalyst layer are dis-

posed cooling spaces and cooling tubes. The heat generated in the oxidation is thus radiated upwards and downwards, and the catalyst does not rise above the temperature for optimum conversion of benzene to maleic acid. Heat is also removed in the gas stream, but radiation in a horizontal direction is small, as the catalyst layers are fifty times as long and broad as they are deep. The cooling means may be so adjusted that the effect is less as the exit end of the reaction tube is approached. As the reaction proceeds, inert gas is produced, and the concentration of oxygen in the gas phase is less, so that heat evolution is also proportionately less, and external cooling is required to a less degree than at the entrance of the tube.

Catalysts

Assuming that the exothermic nature of the partial oxidation reactions can be sufficiently controlled in practice, there still remain other factors to be considered. The rate of oxidation and temperature-rise depend upon the nature and state of the catalyst. Oxides of metals of the fifth and sixth groups of the Periodic Classification are found to be excellent catalysts; in particular vanadium pentoxide is a valuable catalyst, whilst molybdenum oxide is useful. The catalysts may be supported upon inert substances in the ordinary manner, but a catalyst support of unusual nature offers many advantages in the oxidation process. This support consists of small granules of aluminium, rough in nature, and easily produced by stirring molten aluminium whilst solidifying. The catalyst itself may be evaporated from solution on to the support and, specifically, ammonium vanadate solution serves to give a supported vanadium pentoxide catalyst (Barrett Co., English Patent No. 153,877). The composite catalyst is a good conductor of heat—an important point in exothermic oxidation reactions, for excessive local overheating is avoided—and is rigid, thus allowing of easy passage of gases of reaction through the granules in juxtaposition. Disintegration to dust and channelling of reaction gases is impossible, and the support is little affected by reaction with the materials under treatment. If slight oxidation to aluminium oxide does take place, the latter acts as a weak catalyst, and not as a catalyst poison. Finally, recovery of the vanadium oxide catalyst is easily accomplished when required; by solution in concentrated nitric acid, in which, of course, aluminium is substantially insoluble.

Such a catalyst support is worthy of this slightly detailed description, as it is of obvious value in many types of catalytic reaction and, in particular, in all cases of vapour reaction, where large quantities of heat are evolved or required.

The physical condition of the catalyst is of moment, too, for it is apparent that a catalyst deactivated by carbon deposition agglomerated in masses, etc., will not have the activity of fresh, evenly spaced granules. It has, however, been claimed by the Selden Co., of America, in various patent specifications, that vanadium pentoxide which has been fused above about 650° C., or sintered by heating to about 550° C., is more efficient in catalytic oxidation reactions than that oxide produced by gentle ignition of ammonium metavanadate at about 300° C. It is not clear whether the enhanced activity is due to a physical change, however, or whether, in addition, the volatilisation of catalyst poisons—presumably present in the oxide prepared at 300° C.—is effected.

Speed of Oxidation

The speed and success of the oxidation of benzene are dependent upon the concentration of oxygen in the reacting mixture, in addition to the speed of gas passage. The presence of inert gases and of water vapour, and the pressure of the atmosphere in which reaction occurs, are material factors. All the factors should be so adjusted and controlled that heat evolution is not so localised that combustion is set up, in contradistinction to partial oxidation to desired products. Careful temperature control is a *sine qua non* in the matter.

Maleic acid is formed in good yield in the carefully regulated oxidation of benzene. Fumaric acid, the stereoisomer

of maleic acid, is found in the products, having been formed from the latter acid, whilst formaldehyde is also produced. Secondary reactions occur to some extent, and complete combustion to carbon dioxide and water must consume a small part of the benzene, even under the most careful system of temperature regulation. The main product, however, opens up a new field for the subsequent preparation of many useful organic acids, such as malic, succinic, tartaric, propionic, lactic, acrylic, malonic, hydracrylic, etc. In addition, maleic and fumaric acids may find an increasing application in substitution of other nearly related acids. Thus it has been shown by the chemists of the Barrett Co. that their products are of value in the treatment of textiles prior to dyeing. For the bottom chroming of wool, for instance, the acids and their acid sodium salts are capable of giving uniformly good results. The finished materials are as good in their washing properties and fastness to light as when lactic or tartaric acid salts are employed. In top chroming, too, both maleic acid and fumaric acid will replace larger quantities of acetates. In silk dyeing, the use of maleic acid will lead to the production of brighter colours than is the case with any other acid. Finally, for discharge cotton printing, maleic and fumaric acids have been found very useful.

Oxidation of Toluene, etc.

As is to be expected, the homologues of benzene can be catalytically oxidised in a somewhat similar manner. As early as 1892, Walter had shown that toluene could be oxidised to benzoic acid and benzaldehyde by passage with air over heated vanadium pentoxide, but the experiments were of theoretical interest only. It is only possible now, after the intensive studies of the chemists of the Barrett and Selden Companies, to formulate conditions for successful production of partial oxidation compounds.

Toluene is passed with excess of air over vanadium pentoxide at about 300–350° C. The issuing gaseous reaction product is cooled progressively, whereupon benzoic acid is first condensed and later benzaldehyde. Unconverted toluene passes on and may be recovered, or the total gas product remaining after the condensation of benzoic acid and benzaldehyde may be adjusted in respect of oxygen concentration, and submitted to retreatment. Xylene under similar conditions yields substituted benzoic acids and benzaldehydes. In the case of the oxidation of naphthalene, anthracene, etc., precise control of temperature and oxygen concentration is still necessary, but perhaps not so important as in the case of benzene. Naphthalene yields phthalic acid and anhydride, whilst anthraquinone may be produced from anthracene.

Phthalic Anhydride from Naphthalene

Phthalic anhydride is of great value in the production of synthetic dyestuffs, and has been prepared according to the B.A.S.F. method for many years. Naphthalene is oxidised by means of sulphuric acid, in the presence of mercury as catalyst—a process reputed to have been discovered by the accidental breaking of a mercury thermometer in a reaction mass under investigation. The process presents, however, many disadvantages—although more efficient mixed catalysts have been developed—and a clean, high-yielding, vapour catalytic process is eminently desirable. The Selden Co. claim to have this in the process using fused vanadium pentoxide—previously referred to—as catalyst. From figures quoted by Conover and Gibbs it would appear that the process is somewhat slow, and the space-time yield is none too high. Thus, on the basis of the best figures for the specific time of contact with the catalyst, and the best conversion of naphthalene disappeared, it is calculated that little more than 20 gms. of phthalic anhydride per hour could be produced, using a catalyst surface of 100 sq. cm.

Nevertheless, the process is simple. A mixture of naphthalene vapour and air is merely passed over the most suitable catalyst, maintained at about 400° to 425° C.

Vanadium pentoxide is the most suitable catalyst, the oxide of molybdenum, besides being of lower activity, being somewhat volatile in the gas stream.

Certain substances affect the catalytic activity of V_2O_5 and sodium salts should be absent, as well as the vanadates of cobalt. Siliceous impurities are anti-catalytic and the presence of iron or iron oxides is inadvisable. On the other hand, such substances as sulphur dioxide and arsenic trioxide—poisonous

to many catalysts—have no effect upon the activity of vanadium pentoxide, for the oxidation of naphthalene.

Products of Naphthalene Oxidation

The passage of naphthalene vapour in admixture with approximately the amount of air theoretically necessary for phthalic anhydride formation, over a vanadium pentoxide catalyst at about 400° C., leads to the production of a mixture of compounds in which the anhydride predominates. Some naphthalene passes the catalyst unconverted, whilst some is destroyed or burnt completely to carbon dioxide, no carbon monoxide being found in the uncondensable gases of reaction. The amount of carbon dioxide does not represent, however, the whole of the naphthalene disappeared, and small quantities of a brown substance and of a body of irritating odour are formed. Benzoic acid is found in an amount up to 1 per cent., whilst, in addition, 1 and 2 naphthols have been identified.

The products of reaction solid at ordinary temperature are easily condensed from the gas stream issuing from the converter, and phthalic anhydride can readily be obtained from the mixture. By fractional sublimation, for instance, water and unconverted naphthalene can be removed in the first place, whilst phthalic anhydride is easily separated in a similar manner from the brown colouring matter. Alternatively, the product of reaction may be dissolved in a suitable solvent—for example, warm carbon tetrachloride—and treated with a suitable decolorising carbon. After filtration and cooling in stages, phthalic anhydride is first obtained in a crystalline mass, leaving naphthalene in solution.

Oxidation of Mineral Oils

The partial oxidation of hydrocarbons has not been confined to aromatic substances, and many attempts have been made to obtain valuable products from natural mineral oils. Thus the many attempts to produce a suitable fatty acid mixture from mineral oils or paraffin wax during the days of famine in animal and vegetable fats and oils will be recalled. Success has been claimed, particularly by German chemists, but there is no evidence to show that an economic, practical-scale production of fatty acids from hydrocarbons has been achieved. Similarly, chlorination of aliphatic hydrocarbons, and elimination of hydrochloric acid, with subsequent oxidation of the olefine produced, has led to no practical success in the manufacture of fatty acids. Again, the Zelinsky process of using the Grignard reagent upon chlorinated hydrocarbons, with subsequent passage of carbon dioxide and liberation of fatty acid by acidification, has never been a technical success, although there is no question that the series of reactions is capable of realisation in the laboratory, and even in plant-scale apparatus—but at relatively uneconomical cost in the latter instance.

Again, the Frank process of hydrocarbon “cracking” in the presence of oxygen does not appear to have had technical success, from the point of view of obtaining high yields of valuable fatty acids.

On the other hand, however, partial oxidation of the hydrocarbons of natural mineral oil to form fatty aldehyde acids and aldehydes appears to have shown practical results and to have been worked on a semi-practical scale. Moreover, the products sought are not fatty acids alone; and all products of reaction are stated to be capable of utilisation in industry.

In the partial oxidation of the aliphatic hydrocarbons of mineral oil the same precautions are to be observed as in the case of the partial oxidation of aromatic hydrocarbons discussed above. The importance of control of oxygen concentration, speed of passage of the mixed reaction gases, and especially of temperature, is again fundamental. The catalyst must be suitably cooled, and pipes immersed in the catalytic screen, and cooled by water, or in any other suitable manner, may be used.

The catalyst may consist of molybdenum, vanadium, or of uranium oxide, or, in general, other metallic oxides, the metal having a high atomic weight and low atomic volume. Combinations of oxides may be used, and the lower oxide of one metal may serve as the basic constituent of a salt, in which the acidic constituent is the higher oxide of the same or a different metal.

The oxidation of a fuel oil to aldehyde acids and aldehydes has been successfully carried out on a semi-industrial scale. Three catalyst screens, each 1 cm. thick, were employed,

uranium oxide catalysing the oxidation to the formation of aldehydes of high boiling-point, and molybdenum oxide inducing the further oxidation to aldehydo fatty acids. The temperature is preferably kept below 400° C.; the absolute maximum is 500° C. Reaction commences at about 250° C., but is slow, and, moreover, many hydrocarbon oils cannot be volatilised at this temperature.

Air is added before each catalyst screen; and the latter are cooled by immersed cooling pipes. Thus, working at a speed of oil flow of 6 litres per hour, with an air addition of 130 litres per minute, an 80 per cent. yield of an oil was obtained. This product contained 30 per cent. of aldehydo acids, 20 per cent. of aldehydes boiling above 200° C., and the remainder consisted of oxidised bodies, hydrocarbons, etc.—the so-called "congeneric oil."

The products of the partial oxidation may be applied in various ways, but the aldehydo acids have been studied most carefully. These acids can be separated from the reaction product by means of alkali; but, naturally, caustic soda effects resinification. The acids recovered from the mass extracted with caustic soda, therefore, are dark coloured and resinous, but may find application as a cheap varnish gum. The calcium salts or soaps are insoluble, and can be obtained without darkening, and the acids can be liberated from these by treatment with hydrochloric acid. Good-coloured soda soaps may be prepared from the free acids so obtained, or from the original lime soaps. The lime soaps may also be employed in the manufacture of lubricating greases, in combination with the above-mentioned "congeneric oils" and water. They may find application in waterproofing fabrics.

Apart from the aldehydo acids and high-boiling aldehydes, the residue of lower boiling hydrocarbons, formed by the thermal decomposition of the original hydrocarbons, contains oxidised products, and may be termed "oxidised kerosene." This material may find application, it is considered, as a fuel for internal combustion engines, either in kerosene engines or in ordinary engines, if gasoline be used in addition. The oxidised kerosene may also serve as a starting material in "cracking" processes.

The higher fractions of the oxidised product, after removal of the aldehydo acids, are suitable for lubrication purposes. The effect of the addition of glycerides or even of small quantities of free fatty acids (compare Wells and Southcombe's well-known work on lubrication) upon the lubricating value of mineral oils is well known. It is found that the oxidised product from hydrocarbon treatment in the above-described process is useful as a lubricant, either alone or in blended oils.

The high molecular weight aldehydo bodies certainly resinify in the presence of caustic soda, but under other conditions are more stable than the ordinary free fatty acids.

Finally, the whole product from the oxidation process may be employed advantageously as a frothing agent, in the froth-flotation system of ore concentration. The acids contained in the product are the real frothing agents, but it is unnecessary to go to the expense of separating them, as the whole oil-product may be used. In general, it is about one-half as efficient as the best pine oil, and is capable of production at a very much lower figure than that at which pine oil or its equivalent is procurable at the mines.

Premature Scrapping of Old Plant

"Do not scrap your old power plant equipment for the purchase of new equipment until you are sure that correct combustion methods are getting the best results out of the old plant," advises the United States Bureau of Mines. The fuel economy of the plant may be better than its anxious friends realise. For instance, a watchful superintendent of a Government plant, knowing that improvements in plant equipment had been made since his stokers were installed, was almost persuaded to substitute a new type. The Bureau of Mines was asked to ascertain the actual performance of the old stokers and found the plant already doing from three to five per cent. better than was promised for the new equipment. Details of the Bureau's experimental work in determining the potential plant performance in the case referred to are given in Serial 2373, "Fuel Economy from Old Plant Equipment," which has just been published.

Disposal of Waste Organic Matter

Progress of Birmingham Scheme

CONSIDERABLE progress has been made in recent years with regard to the disposal of waste organic matter, and on the huge estate of the Birmingham Tame and Rea District Drainage Board at Birmingham, biological methods have completely superseded those of irrigation, which required the use of large areas of agricultural land. It is pointed out by Mr. F. R. O'Shaughnessy, sewage chemist and adviser to various authorities (for seventeen years he has been the secretary of the Midland section of the Society of Chemical Industry), that the problem facing the chemist in the disposal of masses of waste organic matter is of a dual character, partly bio-chemical, partly bio-physical. In the ordinary course of nature, dead organic matter changes slowly at first, the action becoming more vigorous as time elapses. Under these conditions, objectionable volatile substances are produced in the earlier stages which make the presence of the putrefying material rather painfully apparent by the odours produced. Such volatile products of decomposition are relatively small in amount, although so pungent. As a result of close and accurate observation backed up by careful and prolonged experiment, Mr. O'Shaughnessy established the fact that the course of the bio-chemical change could be profoundly altered by compelling the organic matter to undergo vigorous fermentation of a special kind from the start; and the production of the offensive volatile materials could be thereby eliminated altogether. Thus a new principle of the utmost practical importance to the community at large was established, and the rather curious paradox appeared in the promotion of intense action in the putrefying mass without any accompanying offensive smell. Putrefaction can only proceed in the presence of water, and the course of the re-action depends on the amount of water present. The adjustment of the right proportions of water was one of the most important factors in achieving the foregoing remarkable result.

Difficult as the bio-chemical side of the problem was, the other or bio-physical aspect was still more formidable; for this involved the complete transformation of the physical character of the materials from a sticky unhandleable mass of the type of gum or paste to a condition resembling black earth which may be dried in a reasonable time. This physical change is exceedingly slow even under intensive biological action, and at moderate temperatures requires several months to complete it. It will be apparent that prolonged investigation in the laboratory was necessary. Next, the principles having been established, the process had to be set going on a large scale, where, instead of dealing with ounces, one had to deal with many thousands of tons. Success now depended on a proper organisation of all the huge operations entailed. The refuse of a million people is now dealt with on a relatively small area completely surrounded by houses and industrial establishments, the occupants of which are unaware of the work being done there. The original materials submitted to this process of transformation are partly gaseous, partly liquid, and partly solid. The gaseous products are very considerable, representing no less than one-third of the original dry solids. They consist chiefly of hydrocarbons and carbon di-oxide, the mixture having a high calorific value, and certain of these hydro-carbons present in minute amount give a faint tar-like odour to the fermenting mass. The liquid portion contains most of the disintegrated nitrogen in the form of ammonia and allied substances. Finally, the solid, which is black and inodorous, represents two-thirds of the original solids, and dries in the air to a peaty-looking hard material, containing still such properties of nitrogen (about 2½ per cent.), phosphate, potash, silica, etc., that it possesses considerable manurial value. Farmers, as they become familiarised with the properties of this relatively new material, are appreciating its merits, particularly as organic fertilisers are becoming scarcer and dearer. The process thus outlined has been established on a firm basis in Birmingham; and other towns, appreciating its merits, are also adopting it.

German Reparation Dyestuffs

Statement by B.D.C. Secretary

RESPECTING the appointment by the Board of Trade of the British Dyestuffs Corporation as the agency for the distribution of German reparation dyestuffs, Mr. D. R. Mackey, secretary of the Corporation, has made the following statement:—"This is a matter on which the Board of Trade ought to make a statement, and not ourselves. The criticisms that are urged against the change from the Central Importing Agency to ourselves as the people handling the German reparation dyes are based on an entire misconception of facts. We are simply the agents of the Government in this matter, and we shall merely get a commission on the sale of reparation dyes. All the reparation dyes that come to us will be handled in a separate department, away from our own products altogether. All the proceeds of sales will go to the Government and all sales will take place at prices fixed by the Government. We simply take the place of the Central Importing Agency. When the Government send us any reparation dyes we shall acquaint the trade with what we have received, and the trade will send their orders and we shall have to account to the Government for everything that we do. It is not for me to say anything as to the reasons for the change of policy. The Board of Trade are the people to say why the Central Importing Agency is ceasing to handle German dyes."

Sir William Alexander, chairman of the Corporation, states that in taking over from the Board of Trade the agency for the distribution of the reparation dyes (and it is only an agency), the Corporation has been influenced by the recommendations of some of the largest colour users in this country.

Inquiries at the Board of Trade (the *Times* states) confirmed the statement of Mr. R. D. Mackey with regard to the handing over of the distribution of German reparation dyes to the Corporation. It was stated that one distributing agent was merely being substituted for another; that the dyestuffs would be sold quite definitely and clearly as German dyes, and would not be passed off as British products, and that the whole of the profits would accrue to the British Government, the Corporation merely receiving a small commission. There was no question of selling reparation dyes to the Corporation; the dyes would remain the property of the Government, but would be distributed by the Corporation, as agents for the Board of Trade. The Corporation would do all necessary work in the way of storage and packing, etc. The Board of Trade would exercise the same control of prices as existed at present. It was hoped that the new arrangements would result in a better service to the consumers.

Colour Users' Attitude

The Council of the Colour Users' Association at a meeting in Manchester on Friday, September 15th, had the matter under consideration. The meeting was private, and at the close the chairman, Mr. H. Sutcliffe Smith, stated that they had discussed the position from every point of view and had decided to adjourn further consideration of the matter so that they might get information from every section of the industry. Invited to express his own opinion on the position, Mr. Smith said the matter was so complicated and so many interests were involved—the large user and the small user, the chemist, the dyer, the agent, and so forth—that it was impossible to touch the issue without impinging upon the rights of somebody or other. Colour users, however, could rest assured that their interests would be safeguarded by the Association. Other members of the Association who were approached preferred not to express an opinion at present.

In a statement made later, Mr. Sutcliffe Smith, after commenting upon the complexity of the situation, the divergent views upon the transfer held by all interested in the colour question, and the hopes and fears of the different interests affected, said: "The official intimation from the Board of Trade as to the transfer from the Central Importing Agency to the British Dyestuffs Corporation, Ltd., of the agency for the distribution of German reparation colour was considered. No reason for the change was given, and it is understood that the distribution will be carried on by the British Dyestuffs Corporation on somewhat similar lines to those of the Central Importing Agency, and that the actual requisitioning on Germany of reparation dyestuffs will be undertaken as hitherto by the Board of Trade in collaboration with the Colour Users'

Association. In some quarters it is feared that the change will mean the elimination of the existing recognised channels of distribution, and this point was fully discussed by the Council. It was eventually decided, however, not to comment upon the new arrangement until the chairman had elicited further information from the Board of Trade. The statement that the Colour Users' Association has shown themselves suspicious and full of objection to everything the British Dyestuffs Corporation has lately done, is incorrect, and the Association, whilst having the liberty of criticism, have tried to be as helpful and sympathetic to the British dyestuffs industry as possible. In the meantime the Colour Users' Association are endeavouring to ascertain exactly on what lines this agency will be worked, after which they will be able to give a more considered judgment. It may be taken that the best endeavours will be made by this Association to safeguard the interests of all colour users, small and large."

The Future of the Chemical Industry Club

BY A MEMBER.

THE Chemical Industry Club had a good discussion at their monthly meeting on the 18th inst. Dr. Stephen Miall began with some criticisms and suggestions, but these were both few and indefinite; he seemed to be of the opinion that the Club was doing a very useful piece of work in co-ordinating the chemists and gradually providing them with a sense of what the Trade Unions call "solidarity," and that with ordinary luck the Club would gradually attain to greater importance and usefulness if it continued its present activities and traditions. A good many of the speakers realised the vital work which the Club is doing and will continue to do in giving chemists some common ground from which they can influence public opinion. With this view most of us agree entirely. The Club is a pleasant and well-managed club; unless this continues to be a true verdict the Club will speedily disappear. On the other hand, if it is this and nothing more it may fail to justify its existence. It must be a place of resort for professors, manufacturers, works chemists, merchants and all others who can help to put chemistry on a better footing, where "Chymists," "Spagirists" (whatever they are) and "Ionists" may be found in the smoking room, maintaining with no little heat their various opinions. Those who believe in the Club's future look forward to the time when every chemical man coming up to London will naturally come to the Club to meet old acquaintances and hear the various presidents and treasurers discuss high politics and diplomacy. The Club is already attaining to the first stages of this vision, and the Federal Council has done a little to draw attention to the great task the Club is undertaking. It could do more, and one trusts that it and the Councils of some of the other Societies will assist in the good work.

If the Club continues to progress during the next two or three years (and one feels quite confident about this) it will be an Institution, membership of which will be a valued privilege. There will no doubt be a waiting list of applications for membership, and what is now a mere formality will be an honour to which not every aspirant will attain. All those who desire an important and powerful Club where opinions may be focussed, and all those who have a feeling that they would, for purely selfish reasons, like to be members of such a Club, if they are not already members, will be well advised to take the appropriate steps in the course of the next year or so. The Club will continue to improve, and he who should pronounce that it is already perfect would, as Dr. Johnson or someone else said, be disseminating falsehood without incurring favour and risking the disgrace of detection without participating in the advantage of success.

Diatomaceous Earth Studies

AN investigation, having as its general object the stimulation of the development of the non-metallic resources of the Far West, particularly of Nevada, has been undertaken by the United States Bureau of Mines. For the present the work will be confined to a study of the mining and utilisation of the deposits of diatomaceous earth occurring in Nevada. Correspondence with users of diatomaceous earth shows that the different industries using this material apply a variety of testing methods, and that there are few definite and rigid specifications employed.

British Association: Papers on the Nitrogen Industry

By J. H. West, C. J. Goodwin and Dr. E. B. Maxted

We give below our concluding reports of the discussions at the British Association at Hull. The papers by Messrs. West and Goodwin, who were unable to attend, were read by Professor C. H. Desch.

Raw Materials for Synthetic Ammonia

Paper by Mr. J. H. West

THE discussion on "The Nitrogen Industry" having been opened by Dr. Harker (reported in our last issue), the next paper was by Mr. J. H. West, on "Raw Materials for Synthetic Ammonia: The Manufacture of Hydrogen and Nitrogen." Mr. West said that the raw materials for making synthetic ammonia were both gases, hence their storage and handling were a simple matter. Nitrogen was the valuable constituent of the ammonia, yet three volumes of hydrogen were required to one of nitrogen, and the hydrogen was more expensive to make, so that the cost of production of synthetic ammonia was largely dependent upon that of hydrogen. There were two main sources of commercial hydrogen, coal and water, and one way of getting hydrogen from water is by electrolysis. The resulting gas was very pure, but the capital cost of the plant very high, amounting to not less than £5 per electrical horse power of battery installed, together with another £2 10s. for rotary converters. Even these figures could only be realised on extremely large plants, where cells taking 10,000 to 15,000 amperes each were used. The amount of electric energy required to produce hydrogen in large quantities was also very great, amounting to over 7,000 kw per million cubic ft. of hydrogen produced per 24 hours. It was only in exceptional cases, therefore, where very cheap hydro-electric power was available, that electrolytic hydrogen could be considered. Hydrogen could also be obtained from water by decomposition in contact with red hot iron, as in the well-known Lane process, but this was too expensive a method for use in connection with synthetic ammonia.

Many coals contained about 5 per cent. by weight of hydrogen, equivalent to about 21,000 cu. ft. per ton of coal. On distilling coal in retorts or coke ovens, about a quarter of the hydrogen was set free, the other three-quarters remaining in the tar oils and ammonia. Coke oven gas, where available, was an excellent source of hydrogen, which could be separated from it by liquefying all the gases present except the hydrogen, after having removed the carbon dioxide by absorption in water under pressure. The last 1 or 2 per cent. of carbon monoxide which remained after the liquefaction process might be removed by washing with ammoniacal cuprous chloride, or they might be converted with part of the hydrogen into methane in the presence of a catalyst. Complete removal of carbon monoxide was most important, since this gas was a deadly poison to the ammonia catalyst.

Next there was the interaction of steam and hot coke, giving water gas, which contains about 50 per cent. hydrogen and 40 per cent. carbon monoxide, the yield being about 55,000 cu. ft. of gas per ton of coke. The carbon monoxide in water gas might be caused to react with steam in the presence of a catalyst, producing carbon dioxide and hydrogen, according to the equation $\text{CO} + \text{H}_2\text{O} = \text{CO}_2 + \text{H}_2$.

Finally, there was a new process which had been worked out by Dr. A. Jacques and the author, which combined the distillation of coal in a retort, the formation of water gas from the resulting coke, and the conversion of the carbon monoxide produced in these two operations into carbon dioxide and hydrogen by reaction with steam in the presence of a catalyst in one apparatus, thus giving the maximum possible yield of hydrogen from a ton of coal, and avoiding the heat and carbon losses incurred in withdrawing hot coke from retorts into the air and quenching it with water. The hydrogen present in the coal was practically all liberated in this process, by passing the crude coal gas through a hot zone in the producer, so that all tar oils and hydrocarbons were cracked or split up into hydrogen and carbon, the carbon reacting with steam to form water gas. The process was carried out in a modified form of Tully Complete Gasification Plant, and the only products were gas and ashes. Nitrogen could be made in an ordinary liquid air plant at a cost of a few pence

per thousand cu. ft. The residual gas contained about 65 per cent. of oxygen, and might be employed in various ways, as, for example, the oxidation of ammonia to nitric acid.

Another method was to burn out the oxygen of air with hydrogen. In other words, a measured quantity of air was added to the hydrogen and the mixture was passed over a catalyst, so that combustion took place quietly, and a mixture of hydrogen and nitrogen in the desired proportions resulted. In the Haber process, water gas was mixed with air producer gas, so that sufficient nitrogen remained in the mixture after treatment for conversion of the carbon monoxide, the final adjustment to the exact proportions being made by adding a little pure nitrogen obtained from liquid air.

Prospective Developments in the Häusser Process

Paper by C. J. Goodwin, B.Sc., A.M. Inst. C.E.

THIS paper (Mr. Goodwin stated) has been contributed at the request of the British Association, and the author feels that a general discussion on the subject of nitrogen fixation would not be complete without some reference to the future possibilities of direct fixation of nitrogen as nitric oxides by the explosion process, particularly as during the last eight years practically nothing has been published in the English language.

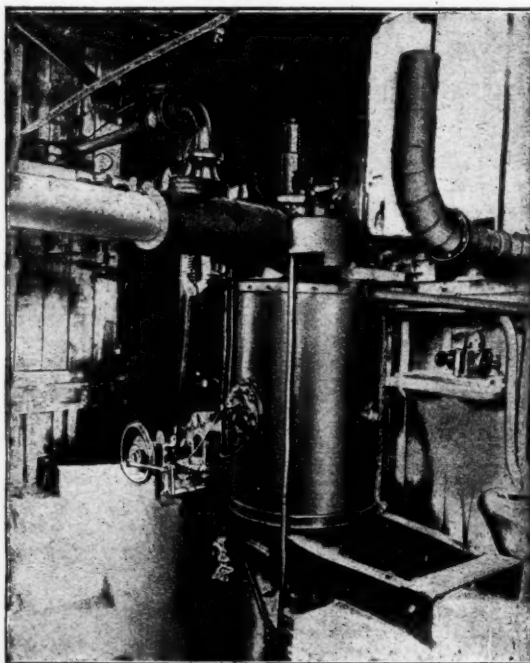


Fig. 1. The First Explosion Bomb

A general solution of the nitrogen fixation problem is unlikely to be attained by one single method or application, and it is clear that each one of several methods must ultimately play its part in the general scheme of things, whether such part be large or relatively insignificant.

It is recognised that the manufacture of synthetic ammonia will probably be the dominating influence, and the economic failure of the arc process, except under exceptionally favourable conditions, will restrict the future of the latter to relatively small dimensions. The same remarks are apposite to a greater or lesser degree to cyanamide, cyanide and other

processes which have been, or are being, tried out; but, in contra-distinction to these indirect processes, the explosion process seems to be the only one which may render it possible economically to manufacture nitric acid by a direct process.

In consequence of the technical and commercial success which has been attained in the manufacture of synthetic ammonia, the impression created is that such ammonia in future will be the principal raw material for nitric acid manufacture, it being an easy matter to convert the ammonia to nitric oxide and nitric acid by the Ostwald process. Provided that the nitric acid can be made direct in suitable plant at the same cost per ton of fixed nitrogen by means of a direct process, the use of synthetic ammonia for nitric acid manufacture is economically unsound and incorrect in principle.

The plant required for synthetic ammonia manufacture involves heavy capital expenditure, and provided there is an

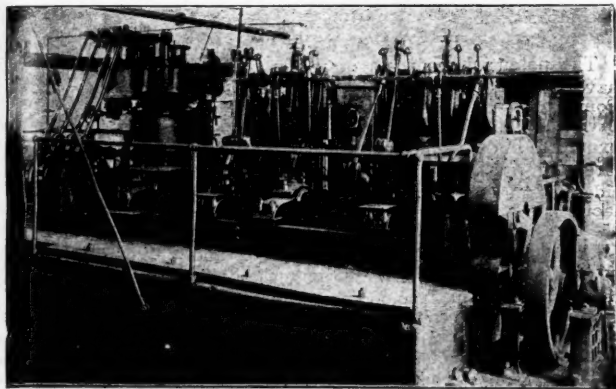


Fig. 2. The Bombs in the Works Plant

assured output for the whole of the ammonia produced, nitric acid requirements can be better provided for by a direct process in cheaper plant at the same cost.

Possibilities of Development

As recent developments in the Häusser explosion process have brought the commercial realisation of these statements in sight, it is proposed to discuss in the following notes the possibility of developments of this method of nitrogen fixation within its allotted sphere.

The details of Häusser's researches and trials prior to and during the war were recently communicated through the author to the *Journal of the Society of Chemical Industry* (41, pp. 253-259R). A critical and detailed summary also appears in appendix 5 of the final report of the Nitrogen Products Committee, pp. 277-285; and these two articles should be studied in arriving at a proper perspective of the prospects. Suffice it to say that the Nitrogen Products Committee rightly concluded that for the successful conduct of the war other processes would give more immediate and satisfactory results, and for the same reason development of the process in Germany was also suspended.

Briefly, the explosion process has been narrowed down to the use of gases of high calorific value, preferably coke oven gas or vapourised liquid fuel, which are exploded either in a bomb or special form of gas engine, the resulting high temperatures and pressures inducing the formation of nitric oxide, which, on rapid cooling of the gases, remains unchanged to the extent of between one-half and 1 per cent. by volume. Attempts to increase the yield by the use of oxygen were successful, but practical difficulties and particularly pre-ignition have led to this line of development being abandoned for the time being.

Researches and trials were continued until a plant comprising two or three bombs of 300 litres capacity was installed and worked for some time with an output of about two tons of nitric acid per day. The yield of nitric acid per cubic metre of coke oven gas of 4,000 calories per cubic metre was about 100 grammes of HNO_3 , and some 60 per cent. of this was recovered in practice. This yield and the cost of the plant used at the time, using normal methods of absorption, spelt technical success but commercial failure, as compared with the use of synthetic ammonia. Häusser has found that every increase in the capacity of the bombs used has led to increase in the yield of nitric acid, and a plant is now to be

installed with a bomb of 1,200 to 1,500 litres capacity, from which, on theoretical and practical grounds, an increase of up to 50 per cent. in yield is to be expected, viz., 150 grammes and upwards of HNO_3 per cubic metre of coke oven gas. This increase by itself would also be insufficient to make the process thoroughly commercial, because by analogy with the arc process in which gases of similar concentration must be absorbed the cost of the towers is excessive.

The researches of Bodenstein (*Zeitschrift für Elektrochemie*, 1916, 24, 183) have, however, shown that the reaction velocity of the transformation of nitric oxide to nitrogen peroxide is about twenty times as great at a pressure of 4 atm. absolute as at atmospheric pressure. Calculations show that when the absorption plant is worked at 4 atm. absolute, the total time of oxidation, and therefore the amount of oxidation space required in the absorption tower system, could be reduced to about 1½ per cent. of that required at atmospheric pressure.

As the gases exhausted from the explosion process are preferably at 2½ to 4 atm. pressure, the size and cost of the absorption system is correspondingly reduced, but a suitable material to withstand both the pressure and, in addition, the corrosive action of nitric acid is essential. The difficulty is likely to be overcome by the use of modern alloys, high silicon iron castings or stainless steels, such as the chromium nickel steels developed by Firth and Krupp.

Absorption Tower System

The author, when designing a plant for the Belgian Government in 1912, devised a very compact absorption tower system in which an oxidation chamber was provided after each tower in addition to the preliminary oxidation tower, which was provided with special circulating devices. A similar system of absorption towers has given improved results in connection with a Häusser plant. It should be particularly noted that the Häusser process can be economically worked on quite a small scale, while synthetic ammonia plant and other systems of nitrogen fixation must necessarily be on a very large scale, and in case of a shut down like that occasioned by the explosion at the synthetic ammonia plant at Oppau, the effect on production and markets would be very serious. A well designed Häusser plant requires no external energy, the motive power for compressors, pumps, etc., being fully covered by suitable methods of heat and energy recovery within the plant. It follows that the Häusser process can be developed in

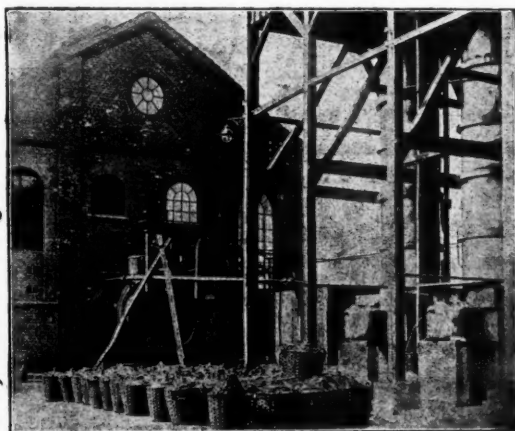


Fig. 3. Exhaust Vessel, Pressure Vessel, and Cooler

outlying districts where under normal circumstances nitrogen fixation would be quite uneconomical.

The yield from the explosion process is negligible at temperatures below 2,000° C., but the temperature obtained by the explosion of coke oven gas with air is about 2,300° C., giving an exit gas containing 0.8 per cent. NO. The author has recently applied for patent protection for the use of coke oven or similar gases, the calorific value of which has been increased by the removal of a part or the whole of the hydrogen, or by their enrichment in other ways. With gases of higher calorific value the nitric oxide is formed at a higher temperature with a corresponding increase in yield and efficiency. At the same time the hydrogen abstracted from the coke oven

or other gases could be profitably or economically diverted to the manufacture of synthetic ammonia, hydrogenation processes, etc., so that the explosion process could be considered as a possibly useful adjunct to synthetic ammonia plant and coke oven plants, while in places where liquid fuel is cheap, and the cost of making nitric acid is relatively high, there may be scope for the installation of Häusser units solely for the latter purpose.

There are other methods than fractional liquefaction, of removing hydrogen and also some carbon monoxide from coke oven and similar industrial gases, and perhaps Calvert's, of making methyl and ethyl alcohol from gases containing two parts of hydrogen and one part of carbon monoxide by volume may be cited as a case in point.

It is not proposed to refer in detail to these possibilities, and the general interest will be found sufficiently served by drawing attention to them. Although bombs have proved perfectly satisfactory in operation, there remains the possibility of carrying out the explosion process in other types of plant or apparatus, and by using a special gas engine, or preferably a modified type of Humphrey Pump, it is possible that a greater percentage of the calorific value of the gases or liquid fuels would be converted into useful energy. Such plant would necessarily be of a more complicated nature than a bomb installation, and it is doubtful whether there would be any real gain on balance.

It is not proposed to discuss the design of such a plant in this brief contribution, but it may be mentioned that the use of a modified type of Humphrey pump would help to overcome several of the difficulties and inconveniences inseparable from the use of bombs worked at high temperatures. Alloy steels have already solved the difficulties encountered in operating exhaust valves at high pressure and in contact with hot gases, and modern materials and methods have enabled other difficulties to be reduced to a minimum, but in the author's view the aim should always be the simplification of plant and not its complication. This, and a proper perspective as to the scope and relative value of each method of nitrogen fixation, should result from the present discussion to which the author has endeavoured to contribute his quota.

Relationship between Water Power and Nitrogen Fixation

Paper by Dr. E. B. Maxted

DR. E. B. MAXTED then read a paper on "Some Aspects of the Relationship between Water Power and Nitrogen Fixation."

The fixation of nitrogen, he said, by any of the three principal processes, namely, by the synthesis of nitric oxide in the high tension arc flame, by the production of calcium cyanamide, and by the synthesis of ammonia, involves in each case two economic factors, which may conveniently be grouped under the headings of power and materials. The predominance of the one or the other of these factors will determine, not only the most suitable site for the operation of the process within a given country, but also the economic practicability of the method of fixation under given geographical and mineralogical conditions. Thus, the arc process, in which the availability of cheap electrical energy is by far the most important necessary condition for industrial success, is confined geographically to districts suitable for the development of hydro-electric power, while, on the other hand, the principal advantage of the direct synthesis of ammonia from the standpoint of national economics lies in its relatively low power factor and, consequently, in its comparative independence of peculiar geographical conditions. The manufacture of calcium cyanamide stands in an intermediate position, in that the consumption of power, on the one hand, and of the requisite materials—coal and lime—on the other, is balanced in such a way that carbide factories are capable of economic existence either at the source of hydro-electric power, or at the source of cheap coal and lime, in which the increased cost of power generated from fuel is compensated by the absence of large freightage charges for the raw materials required, and possibly also for the finished product. As an example of the supply of raw materials to a carbide factory of the first type, it is interesting to note that in 1914 some 50,000 tons of British anthracite were exported to Norway for the manufacture of carbide.

Under British conditions, it is probable, save, perhaps, for the manufacture of nitric acid as such, contrasted with the broader problem of fixed nitrogen for agricultural purposes, that two only of the above processes, namely, the manufacture of calcium cyanamide and the direct synthesis of ammonia, are economically possible.

The author then dealt briefly with a number of points connected with the relationship of these processes to hydro-electric power, with especial reference to the position in Great Britain. The synthesis of ammonia itself, he said, possesses a relatively low power factor, and might be regarded as economically independent of cheap power, were it not that the hydrogen employed as a necessary raw material may be manufactured by two types of process, namely, from fuel, by way of water and gas, and electrolytically, in which case it may be translated directly into terms of power, the hydrogen being regarded substantially as water plus the energy required for its decomposition.

Water Power

The potential resources of water power in Great Britain have recently been surveyed by the Water Power Resources Committee of the Board of Trade, and water resources estimated to be capable of producing some 250,000 kw, were examined in detail; this figure is not exhaustive. By far the larger proportion of potential water power sites of any considerable magnitude are located in Scotland. An important factor is the maximum power available at a given site, and of the ten Scottish sites reported on favourably, only one was estimated to produce over 30,000 kw., and only two over 20,000 kw. The total power potentially available from the ten sites is about 100,000 kw. In Wales five sites were reported on favourably, of which only one was estimated to have a potential output greater than 5,000 kw. This fact is important, since sites capable of producing less than about 10,000 kw. are not suitable for the production of cyanamide or carbide at the lowest rates. For the synthesis of ammonia the desirable minimum remains yet to be determined, but it is obvious that the cost of power will directly affect the cost of electrolytic hydrogen and of the final product. On the basis of these figures, hydro-electric power on a considerable scale could be rendered available at selected sites in Great Britain, principally in Scotland. An average figure for the capital cost of installation (which will vary from site to site) at the ten Scottish sites considered by the Committee is estimated to be about £30 on a pre-war basis for each kw. installed, at any rate, for the larger sites. The cost of power will depend principally on the interest charged on capital cost. Apart from interest on capital, operating and other costs are relatively low, about 3 per cent. of the capital cost per kw. being quoted as a conservative estimate in the case of an installation of 10,000 kw. or over. Under present conditions, it should be possible to produce power from several of the more suitable sites for about £4 or £5 per kw. year. If energy can be obtained at £5 per kw. year, then, on the basis of a power consumption of about 135 k.w.h. per thousand c. ft. of hydrogen generated by electrolysis—a figure in accordance with results obtained in practice—the cost of power should be about 1s. 7d. per thousand c. ft. of hydrogen, the oxygen being regarded as possessing a problematic value, which, for the purpose of this calculation, has been set down as zero. In addition to the actual power required for electrolysis, there is the initial cost of construction of the hydrogen plant, the capital charge per thousand c. ft. of gas, depreciation, and labour charges, the latter, however, being low in connection with plants of considerable size. The figure of 1s. 7d. per thousand c. ft. would, even with these reservations, appear to compare not unfavourably with the cost of hydrogen from fuel. Moreover, no credit has been given in the case of electrolytic hydrogen, for the oxygen simultaneously produced. In this country it would appear, said the author, that a sufficiently strong case may be established for the generation of hydrogen by electrolysis to warrant, at any rate, a careful examination of the method side by side with hydrogen from fuel.

The Electrolytic Process

The principal drawback of the electrolytic process consists in the relatively large floor space required, and in the multiplicity of cells necessary. These disadvantages are being met to a certain extent by the introduction of large unit cells, and the degree to which this enlargement is practicable, together

with the even more important desirability of a relatively high operating current density, will probably determine to a large extent the industrial future of electrolytic hydrogen, at any rate in cases in which the oxygen is not utilised. The utilisation of relatively large supplies of cheap oxygen in chemical industry presents an important field for research.

The problem was then considered from a slightly different aspect. Assuming that power of a given magnitude, say 10,000 kw, is available at a certain site, and that this power is utilised completely, firstly for the synthesis of ammonia—the hydrogen being generated electrolytically—and secondly, for the production of calcium cyanamide; in the first place, some 5,000 to 5,500 tons of nitrogen per annum could be fixed as synthetic ammonia, about 7,500 to 8,000 kw. of the 10,000 kw. being used for electrolytic, 1,000 kw. for compression, and the remainder for other purposes, including the separation of the requisite nitrogen by a low temperature process from air. Under such conditions the bulk of the power is used for electrolysis. If, on the other hand, the 10,000 kw. were used for the fixation of nitrogen as calcium cyanamide, the weight of nitrogen capable of being fixed per annum would be more or less the same, the important difference being that, in the case of synthetic ammonia, some 33,000 c.ft. per hour of waste oxygen would be available from the hydrogen and nitrogen plants, assuming the latter gas to be separated from air by a process of low temperature separation, whereas, in the case of a cyanamide plant, the whole of the coal and lime required would have to be brought to the factory site and there handled. This would be balanced to a certain degree by the greater simplicity of the cyanamide method, and by the necessity for fixing the ammonia by means of an extraneous acid, unless it be fixed as nitrate—the nitric acid being prepared by the oxidation of ammonia—or transported in the form of its aqueous solution, or as the anhydrous liquid.

In conclusion, the author said that, while the presentation of the matter in this light was not intended as a definite argument for the preferential manufacture of such large quantities of hydrogen by electrolysis, it would appear that the utilisation in Great Britain of hydro-electric power for such a purpose is not impossible, and it is interesting to note that, in a recently published official report on nitrogen fixation in the United States, the question of electrolytic hydrogen for the synthesis of ammonia is also discussed.

The Oppau Explosion

In the course of a short discussion reference was made to the cause of the Oppau explosion. It was stated that the explosion had nothing to do with the process itself. The trouble had been shown to be that about 8,000 tons of what was said to be a mixed salt, nitrate and sulphate of ammonia, was stored in a great silo on the border of the plant at Oppau. This material set in great chunks, and it was not easy to shift it. Holes were drilled, and blasting cartridges inserted. The people concerned were anxious to get through with the job, and used cartridges which were more hefty than was necessary. It should be realised in this country by the authorities who deal with national defence that that plant has been reconstituted, and was ready to operate again at full capacity.

Fifth Report on Fuel Economy

Position Most Unsatisfactory

In the fifth report on fuel economy, the developments since the coal crisis of 1921 were reviewed, and the conclusion reached was the following:—From a fuel economy point of view the position is most unsatisfactory, because at present the prices of coke, as compared with those of coking coals delivered at the works, offer little inducement to iron and steel makers owning self-contained plants to start up the coke ovens connected with their steelworks, since coke can be bought at prices below the cost of making it in their own ovens, even after crediting the values of all the by-products produced in the process. This condition is entirely abnormal; and it is hoped that with improved general trade, freedom from industrial disputes and unrest, and an increase in demand, more blast-furnaces and steelworks will be put into operation, and that the demand for the raw materials will then tend to re-establish more normal conditions in the coal and coke trade,

and thus restore the balance in favour of pursuing a policy which ensures the greatest fuel economy in the operation of plants, which is so desirable in the national interests.

Motor Spirit and Fuel Oil Supplies

The Committee's view is that the only practicable way in which future home supplies of motor spirit and fuel oils can be extended is by the carbonisation of bituminous coals at temperatures between 600° C. and 1,200° C. By carbonising suitable British coals at high temperatures (1,000° C. to 1,200° C.) in gas retorts or by-product coke ovens, there can be obtained between 3 and 6 per cent. of the weight of the dry coal as anhydrous tar, and between 0.75 and 1 per cent. of its weight as refined benzole (motor spirit). It should be borne in mind, however, that, inasmuch as more than half of the coal so carbonised is for the production of hard metallurgical coke, the total production of motor spirit and tars by these methods depends very largely upon conditions in the iron and steel industries which fluctuate, and at the present time are exceedingly bad. Supposing, however, that pre-war prosperity were restored to the iron and steel industries, a total high temperature carbonisation of some 40 million tons of coal per annum might reasonably be expected. Taking 1 per cent. of its weight as a probable outside limit for the ultimate production of refined benzole, the total potential production of the latter would not exceed 400,000 tons per annum, which is very little more than half the tonnage of the motor spirit actually imported into the country in the year 1921. Moreover, of this potential supply nearly half would have to be drawn from the gasworks of the country, and it is at least problematical whether it would pay the gas companies to extract the benzole from their gas at present prices. Indeed, taking the present relative prices of gas and benzole, as well as the costs of recovering benzole from coal gas, it is probable that the cash value of the potential heating power of benzole is greater when left in the gas than it is when extracted therefrom and (after subsequent refining) sold as motor spirit.

Therefore, it has to be recognised that the most promising internal supply of both motor spirit and fuel oils lies in the direction of the low-temperature carbonisation of coal, provided that methods can be devised for same which are sound both from the technical and the commercial points of view. A really successful solution of this problem is greatly to be desired, not only for the aforesaid reasons, but also because it would be a great factor in the abolition of the smoke nuisance, especially from domestic fireplaces. The Committee has paid close attention to the recent developments with regard to this matter which are taking place in this country. The Committee is in general agreement with the view recently expressed by the Fuel Research Board that, although we have not yet reached the stage when a final answer can be given to the question whether or not it will be possible to establish on sound industrial lines a new industry based on the carbonisation of the tens of millions of tons of coal per annum which are at present being consumed in the raw state in this country, yet as the result of the pioneering work which has been done during recent years by various organisations such knowledge and experience has been gained as affords some ground for the expectation that we are approaching a conditional solution of the matter.

There still seems to be some difference of opinion as to whether from the commercial point of view it will be better to carbonise at temperatures round about 600° C. or at somewhat higher temperatures (say, 700° C. to 750° C.), but this may be regarded as a minor issue. It seems now to be established, as the result of fairly large scale trials, that the average yields of the various products now obtainable by carbonising suitable British bituminous coals at a temperature of 600° C. will amount (on the weight of the dry coal carbonised) to about 7.5 per cent. of tars, and about 2.5 gallons per ton of motor spirit, besides about 3,500 cubic feet per ton of a rich gas of a gross calorific value (say) of about 800 B.Th.U., and a 70 to 80 per cent. residue of smokeless semi-coke.

Seeing that the cash value of the semi-coke residue far exceeds that of all the other products put together, and also that the price of fuel oil in this country will probably also be determined by circumstances beyond our control, it seems as though the ultimate prospects of a low-temperature carbonisation industry will depend upon the price which the public will be willing to pay for a smokeless domestic fuel. There can be

little doubt but that such a fuel, properly manufactured, is a very suitable one for domestic consumption; it burns freely and smokelessly, and also, according to Dr. Fishenden's recent experiments (*vide* Fuel Research Board Special Report No. 3), it has a greater radiant efficiency than either coal or high-temperature coke. Its general adoption, however, will probably depend upon two other conditions being fulfilled. Firstly, it must be prepared and distributed in a form which will allow of its being freely handled without undue disintegration. Secondly, if its ash content could be cheaply reduced to a low figure by subjecting the coal to some washing process such as froth flotation or the like before it is carbonised, its attractiveness as a domestic fuel would be undoubtedly greatly increased. Indeed, it seems possible that public opinion might soon be educated to regard with favour well-manufactured smokeless semi-coke of better combustibility and of smaller ash content than raw coal.

The Chemistry of Coal

Progress towards the solution of the problem of the constitution of coal substance can be recorded, notwithstanding the magnitude and complexity of the problem. The difficulties arise in no small measure from the absence from the products of such researches of bodies with crystalline habit or other well-defined physical characters by which the chemist is accustomed to identify the compounds he isolates. Still, the literature shows the subject has attractions for not a few chemists, who, employing various methods of attack, seek to obtain information as to the nature of the multifarious compounds which go to the make-up of coal. As, however, different investigators select for their study coals of varying origin and of different classes, it is not always easy to compare the results obtained.

The work of Clark and Wheeler (*Trans. Chem. Soc.*, 1913, 103, p. 1704), combining the application of solvents with the study of the action of heat upon the extracts of the coal so obtained, has undoubtedly given much useful and valuable information. The results, however, still leave open to conjecture and theoretical explanation the true nature of the components of the several fractions. The classification of the coal components by Clark and Wheeler based upon the pyridine-chloroform treatment is too facile; nor could it be expected to provide material for a complete explanation of the properties of coal.

The breaking down of a bituminous coal by treatment with a mixture of pyridine and amyl alcohol yields an extract from which, by successive use of ether and light petroleum, Bone, Pearson, Sinkinson, and Stockings (*Proc. Roy. Soc., A*, vol. 100, 1922, p. 582) have succeeded in obtaining (1) a non-resinous wax-like substance, (2) a resin, to which the formula $C_{31}H_{55}O_3$ is assigned, (3) a portion, insoluble in ether, consisting of non-resinous material, partially dissolved by alcoholic potash, and this they designate as "humic substance." The authors are satisfied that these humic substances are not "resinic" but "cellulosic" in origin. The influence of these several fractions on the coking of a coal has been studied, with the result that, whereas the said resin is in part responsible, the main cause of the coking propensities was shown to be a series of substances of "humic" type which are soluble in chloroform but not in ether, and whose fusion temperatures are below those at which they undergo rapid decomposition.

The acidic substances extracted by alkalis from the aforesaid humic bodies are precipitated by acids from these solutions as bulky, dark-coloured, opaque jellies. These jellies on drying form black, brittle, lustrous, and structureless masses, with conchoidal fractures, suggestive of the material forming bright coal which Stopes has styled "vitrain." The consideration of these facts has led Bone and his co-workers to suggest that "bright coal" may have originated in a colloidal gel.

In this connection attention may be directed to a like conclusion arrived at by Dr. J. A. Smythe in 1906, in a paper read before the University of Durham Philosophical Society, which dealt with certain Peaty Deposits from a Pit-Fall at Tantobie, County of Durham. Amongst the substances described is a black jelly-like body, which Smythe styled "black-stuff," and this he showed by its composition and behaviour to solvents, notably to pyridine, suggests a similar relationship to bright coal.

It has long been recognised that bituminous coals contain three easily distinguishable components, which until recently

had usually been designated (a) "mother of coal" or "mineral charcoal," (b) "dull hard coal" (Ger. = "Matzkohle"), and (c) "bright coal" (Ger. = "Glanzkohle"), respectively, the last named being a structureless, lustrous substance with a conchoidal fracture. Recently Stopes (*Proc. Roy. Soc., B*, 90 (1919), p. 470) proposed new names for them, namely (a) *fusain*, (b) *durain*, whilst (c) is termed by her either *clarain* or *vitrain*, according as it does or does not contain recognisable plant tissues and structures. In putting forward these proposals Stopes recognised that none of the four said ingredients (with the possible exception of vitrain) are either homogeneous or chemical molecular units; also that they do not even approximately represent the crystals in a petrological section of a rock. Provided that such qualifications are kept clearly in mind, and that it be realised that clarain may prove to be merely vitrain in which plant structures occur in suspension, the Committee sees no great objection to the provisional substitution of the proposed new names for the older ones, regarding the matter more as one of convenience than as involving any new principle.

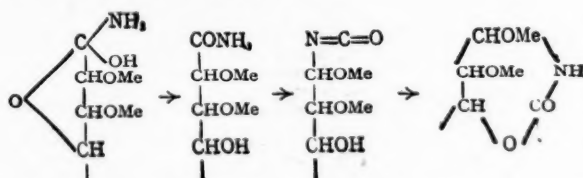
The Committee also feels that the growing practice among coal-chemists to use the terms *alpha*, *beta*, *gamma*, etc., to designate the several components obtainable from the coal substance by fractional extraction of it by means of various solvents, is one which, unless regularised in some definite way, is likely to lead to much confusion and obscurity, to the detriment of progress. It is obvious that coal may be "fractionated" in as many different ways as there are suitable solvents and modes of applying them; and therefore unless, as the results of some particular treatment or procedure, components of a reasonable degree of purity and well-defined properties are isolated, it is undesirable that definite names should be assigned to them, as though they were the actual chemical constituents of the coal instead of unknown mixtures of them. The Committee, therefore, would suggest that the time has come when chemists should agree in conference upon some common plan of labelling such "coal fractions" which whilst recognising them to be such, shall also in some way indicate how they have been obtained.

Supposing, for example, that a particular investigator extracts a coal with two solvents A and B, he might designate the fraction which is insoluble in both as the α AB fraction, whilst β AB might be used to denote the fraction which is soluble in A but not in B, and the γ AB that which is soluble in both A and B, assuming all solvents to be used at their respective boiling points at atmospheric pressure. Thus, a fraction termed the " α pyridine-chloroform" fraction would mean the residual insoluble portion of a coal after successively extracting it with pyridine and chloroform at their respective boiling points; the " β pyridine-chloroform" fraction would be that portion of the pyridine extract which is insoluble in chloroform; whilst the " γ pyridine-chloroform" fraction would mean the portion of the coal which is soluble in both pyridine and chloroform, and so on. In cases where the coal is extracted at some particular temperature other than the boiling point at atmospheric pressure of the solvent employed, the actual temperature employed might be designated by putting it in small type above the name of the solvent, thus, "-benzene^{120°}" denoting that benzene had been used at 120° C.

A New Type of Nitrogenous Sugar Derivative

IN a paper by Mr. John Pryde it was pointed out that, extending his studies on the action of sodium hypochlorite on amides of α -hydroxy acids, Weerman applied his reaction to the amides of simple hexonic acids, and so devised what has proved to be the best practical method of degrading hexoses to pentoses. In the present communication the results of applying this degradation method to a fully methylated hexose were given. The investigation was originally undertaken in the hope that a propylene-oxide form of a methylated arabinose would be obtained in place of the normal butylene-oxide type, or alternatively that the intermediate compounds would be isolated and thus elucidate the course of the reaction as applied to the sugar group. Tetramethylglucose was oxidised to tetramethylgluconic acid, which was isolated as its internal lactone. The lactone, dissolved in absolute

alcohol, was treated with dry ammonia and the amide was isolated in a crystalline condition. Evidence is available to show that this compound does not possess the structure of a true acid amide, but exists in the form of an amino-lactone. On subjecting the amide to the action of cold alkaline hypochlorite a crystalline body of the composition of the intermediate isocyanate was obtained, and from its behaviour the constitution of an internal urethane has been assigned to it. The reaction proceeds as follows:—



The formation of this intermediate urethane affords striking evidence of the stabilising effect of methyl groups in the sugar chain. It is also interesting in showing the conversion of a carbohydrate into a derivative in which nitrogen is present in a stable cyclic substituent.

Reclaimed Rubber

Dr. Torrey's Paper at the Manchester Section

A PAPER on "Reclaimed Rubber" was read by Dr. J. Torrey at a meeting of the Manchester Section of the Institution of Rubber Industry, held on Monday, September 18. Mr. H. Mandleberg presided.

Dr. Torrey said the reclaimer was at this time confronted with an unexpected and a very critical economic problem. For twenty years reclaimed rubber had played a significant part in the manufacture of rubber goods in Great Britain. Economic conditions had now reduced enormously the amounts used, but the manufacturers who had been purchasers were not indifferent to the changed conditions, and it was fitting that the reclaimer should suggest how the relation which had hitherto existed between the manufacturers and the reclaimers should be conserved.

Circumstances had made the United States the foremost reclaimers and users of reclaimed rubber in the world. The grades of scrap rubber handled were few in number. From the start the tendency had been to put on the market a few standard reclaimed rubbers, each representing a product reclaimed from a definite grade of scrap. There was very little blending or mixing. The output was large, and the long uninterrupted runs on the same grade of scrap made for low manufacturing cost and uniform quality. In Great Britain the reclaiming industry had a totally different history. There had been no standardisation; the whole tendency was towards individualisation. One company had in its formula books a hundred separate and distinct reclaimed rubbers, and the analysis of any month's sales would show 38 to 42 grades. The reason for this strong individualisation was that reclaimed rubbers were additions and must fit in with other ingredients, which usually meant the concocting of a special stock. A day's run often consisted of from five to even eight or ten stocks, and, as a rule, the quantities of each were not large. This tended to increase manufacturing costs and made it more difficult to attain uniform quality.

Treatment of Scrap Rubber

What was required now was a method capable of dealing with scrap rubbers containing cotton fabric. The chemicals used must be cheap and abundant, the processes continuous, the machinery simple, necessary labour reduced to a minimum. The question of separating and recovering the cotton as well as the rubber substance had always been in the minds of reclaimers, but there had been good and sufficient reasons why it had not become prominent. The rubber substance had a competitive chance in the market; the cotton certainly had not. With regard to the problem of fabric destruction, none of the solvents for cellulose had proved useful. The conditions under which satisfactory solution could be effected

were too exhausting and too easily disturbed. Then again, unless the chemical was practically valueless, there must be a means of recovering as much as possible to use again. The only two reagents that had proved themselves available were dilute sulphuric acid and caustic soda solution, either concentrated or dilute. The former was effective at boiling point under ordinary atmospheric pressure, but the caustic soda process required closed vessels and fairly high temperatures, usually about 360° F. Both processes were effective and simple. The free sulphur which the scrap rubber contained must be removed if present in ordinary quantities, and this was accomplished by the alkali process at the same time that it destroyed the fabric. The acid process did not do this; therefore it must be supplemented by an alkali treatment to remove the free sulphur, or a scrap must be employed which contained very little free sulphur. Usually the second alternative was adopted, and the most suitable scrap was rubber shoes. It was doubtful whether a finer, all-round reclaimed rubber had ever been produced than the high-class American shoe stocks and the equally useful Russian shoe stocks which were so prominent in pre-war times. The only American reclaimed rubbers that had ever gained a real foothold in this country were those shoe stocks.

In America reclaimed rubber was the staple material in many classes of goods; other substances, such as rubber, minerals, oils, etc., were added to it. In Great Britain the reclaimed rubber was itself an addition only and must fit in with the other substances to produce the desired results as to cost and quality. This made the task of the reclaimer a difficult one, but, nevertheless, reclaimed rubber made steady headway and won a place for itself. The fluctuations in the price of raw rubber had little effect on the demand, and the prices quoted and paid for reclaimed remained practically constant, while raw rubber fluctuated from 2s. 6d. to 10s. per lb. Now all was different. To-day the best crepe could be bought at about 7½d. per lb. What inducement then was there to use reclaimed rubber? It was steadier in price and quality than plantation rubber. It was an effective and safe accelerator of vulcanisation. It was almost impossible to injure it on the mill. It was valuable in tubing machine work. Time was saved in the milling and the vulcanisation. Labour was saved, especially if each class of reclaim went into the kind of goods from which it was reclaimed. If manufacturers resumed the use of it in anything like a whole-hearted way, it would be because it was cheaper to use, and the goods required were produced with less trouble and with less expenditure of time, care, and labour. But this argument was not accomplishing much now, and years might pass before the effect was really significant. Meanwhile the reclaimer could not go on indefinitely catering to a fragmentary and sporadic business. There was no sign of any decided rise in the price of rubber, and the chances were not good of being able to reduce the cost of the reclaimed rubber by the recovery and utilisation of the cotton mixed with the rubber substance. There remains the probability of some new and extensive line of manufacture, such as rubber tiles or blocks for roadways, flooring and roofing. Here the wearing and weather resisting powers of reclaimed rubber would come in, and the labour saving would count very decidedly. It was difficult, however, to see any solution of the problem without some decided change in the general business situation. Most of the grades of scrap rubber were to-day not worth the cost of collection and transportation; much less were they worth reclaiming.

Power Gas from Sewage

THE Birmingham, Tame and Rea District Drainage Board, in their report last week, make the following statement, which is of interest to works managers and chemists, as to the practical application of gas, derived from sewage, for power purposes. As a result of experiments it has been found possible to drive a pump which lifts sewage from the well adjoining the engine house to the irrigation land. The gas available for driving the engine has varied in amount, but it has been possible to keep the well free of sewage, although a gasholder for storage purposes had not been erected. The experiment is regarded by the Board as holding great possibilities of further expansion, but the economic aspect is a matter for further consideration.

From Week to Week

CHEMICAL WORKS are being erected in Jersey for the manufacture of iodine, potash and dyes from seaweed. Until recently this seaweed, of which large quantities are washed up, has been used only as a fertiliser.

M. GEISER has discovered in the Berne Library a book of recipes for making the oil colours which were used by the ancient painters. The book was written in German in 1479 by a monk of Colmar, and is part of the famous Strasbourg manuscript on the technique of painting which was burned in 1870.

AHLMANN (LONDON) LTD., 35, St. John Street, London, E.C.1, announce that as from September 1 their offices and warehouse have been removed to more convenient premises at 9, Phoenix Place, Mount Pleasant, W.C.1 (opposite the G.P.O. Parcels' Post Department). Telephone number: 4682 Clerkenwell.

A RESOLUTION has been introduced in the U.S.A. House of Representatives authorising the War Secretary to sell to the Alabama Power Co. the Government-owned steam plant and sub-station at Gorgas, Alabama, and to permit transmission lines at Sheffield, Alabama, and to lease the nitrate plants at Muscles Shoals.

MR. WILFRID HILL, managing director of the County Chemical Co., Nottingham, speaking at the Midland Council of the National Union of Manufacturers, strongly advised manufacturers to unite together for the defence of themselves and of the industry, in view of the socialist movement for the destruction of capital.

THE DEPARTMENT OF AGRICULTURE of the Basses Alpes is organising a Scent Samples Fair at Digne, to be opened on October 7. A similar fair was held with considerable success at the same period last year, and it is suggested that interested British firms should apply for full particulars to M. le Directeur des Services Agricoles de Digne, Basses Alpes, France.

A LARGE CONTRACT has just been booked by Sir William Arrol and Co., Glasgow, for the erection of new synthetic ammonia works at Stockton-on-Tees. The contract embraces the construction of reinforced concrete bulk-store tanks of extensive capacity. The contractors will begin operations at once, and the undertaking will represent a very substantial sum of money.

THE LARGE ADDITIONS at the Chemical Department of Provan Gas Works, Glasgow, will be ready for use by the end of this month. The Corporation Gas Committee is taking a keen interest in the chemical works, which are now modernised and equipped with the best type of plant for the manufacture of by-products. The new ferro-concrete buildings comprise tanks for the storage of tar and liquor, also coke and ash bunkers designed on approved labour-saving principles.

DURING HIS VISIT to the United States, Mr. F. E. Hamer (editor of THE CHEMICAL AGE) will address the members of the Chemists' Club, New York, on "Some public aspects of British chemical industry," and at the invitation of Dr. Parsons, secretary of the American Chemical Society, and Mr. H. E. Howe, editor of the *Journal*, will visit Washington and inquire into the organisation and activities of the Society. A series of articles giving impressions of American chemical industry will in due course appear in THE CHEMICAL AGE.

A SATISFACTORY REPORT from the Federated Malay States recording the continued successful growth of the fibrous plant grown by the Arghan Co., and the company have now received a cable announcing a favourable analysis of the soil of the concession recently granted by the F.M.S. Government. News has also been received that the first sample of fibre actually grown upon the company's concession is on its way to London, and its arrival is awaited with no small interest, since it marks another important step in the development of this new plantation industry.

Dr. R. C. FARMER, O.B.E., has been invited to take up the position of Deputy-Director of Explosives Research at the War Office Research Department, and will commence duty in October. Dr. Farmer was formerly chemical adviser to the Explosives Department under Lord Moulton, and was a member of the Nitrogen Products Committee and the Chemical Committee of the Munitions Inventions Department. Since the armistice he has been a director of Messrs. W. J. Bush

and Co., Ltd., chemical manufacturers, of Hackney, London, which position he is now resigning.

FRITZ GERBER, a German, was fined £20 by the Sunderland magistrates last week on a charge of knowingly harbouring and concealing a quantity of chemicals known as novocain. This was the first case under the Safeguarding of Industries Act. Gerber was steward of a German steamer, and the Custom House officer discovered 24 cases, containing 600 bottles of novocain, a local anæsthetic used in dentistry. The accused pleaded that he bought the chemicals in Germany, and intended to take them to Russia to a dental friend, and never intended to dispose of them in England.

THE FIRST MEETING of the Chemical Industry Club for the winter session took place in the smoking-room of the club on Monday evening. Mr. W. J. U. Woolcock, M.P., occupied the chair, and an address was given by Dr. S. Miall upon "The Club—some Criticisms and Suggestions." A discussion followed, and several useful suggestions were put forward. The hon. secretary drew the attention of members to the proposal that on and after January 1 next an entrance fee would be charged to applicants for membership providing the proposal is approved at the annual general meeting. Reference was also made to the forthcoming annual dinner on November 24.

Sir HUMPHREY D. ROLLESTON, president of the Royal College of Physicians, visited Chester Royal Infirmary on Saturday to open the pathological and bacteriological laboratory established as a memorial to the late Dr. John Elliott, of Chester, who for 26 years was hon. physician of Chester Infirmary. He said the inestimable value of a well-equipped and staffed pathological and bacteriological laboratory, with its rapid decision of clinically doubtful diagnoses, was now established, but it must be admitted that some who had grown up with it might be tempted to rely solely on its verdict, and so save themselves the trouble of investigating the patient. The old adage, that the patient, and not the disease, must be treated, should not be forgotten.

CENTRIFUGAL SEPARATORS, LTD., 8, Idlesleigh House, Caxton Street, Westminster, have for some time past had under consideration the advisability of centralising their general offices and demonstration works. They have decided to extend their existing works at Peckham, and new offices and laboratories are now in course of erection. It is proposed to close down the offices at Idlesleigh House as from September 27, and on and after that date all communications should be addressed to the company at 161, Queen's Road, Peckham, London, S.E.15. Telephone No.: New Cross 1984. Telegrams: Geewhiz Peck, London. The registered office of the company will remain at 14, Queen Victoria Street, London, E.C.4.

THE INSTITUTE OF METALS, which is visiting Wales for the first time, opened its autumn meetings at Swansea this week under the presidency of Mr. Sumner, Manchester. Alderman W. Owen (Mayor of Swansea) extended to the 160 delegates a hearty welcome. The Mayor stated that Swansea was the greatest metallurgical centre of the world. In returning thanks, the president said he thought the Mayor was quite right in claiming that Swansea was the greatest metallurgical centre. He said that with due deference to the claims of their friends from Birmingham and Sheffield. The members were entertained at luncheon by the Trade Associations, and afterwards inspected Swansea University College.

A BIOGRAPHICAL SKETCH of Dr. F. B. Power is forwarded by the Wellcome Chemical Research Laboratories, to the directorship of which Dr. Power was appointed in 1896 by Mr. H. S. Wellcome. He remained in London for over 18 years, and during that period became well known for his researches, especially in plant chemistry. Dr. Power was elected a fellow of the London Chemical Society in 1896, and he was also intimately associated with the Society of Chemical Industry, on the Council and Publication Committee of which he served for several years. He resigned his position in London the latter part of 1914 to enable him to return to his native country and be near his family. On retiring, a gold medal bearing his profile portrait in relief was awarded him by Mr. Henry S. Wellcome in recognition of his distinguished services to science during the eighteen and a half years he was director of the Wellcome Chemical Research Laboratories.

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New British Yeast Works

It is reported that a new works for the manufacture of yeast by a new non-alcoholic process, formerly the monopoly of Germany, is to be built at Nottingham by a syndicate of ex-officers. The promoters of the scheme have formed a company with the title of the British Yeast Manufacturing Company (Limited), which has a capital of £120,000. The new works, for which a large site has been selected on the Colwick estate, will be planned for an output of about 5,000 tons of "air yeast." The construction of the factory will shortly be commenced, the plans having been prepared by Major Geddie, who has lately returned from important work for the Brazilian Government.

United States Chemical Foundation

Action by American Chemical Society

In a concise summary of the position of the United States Chemical Foundation, *Nature* states that early in July last, President Harding instructed the Alien Property Custodian of the United States to demand the return of all patents, trade marks, etc., which had been sold to the Chemical Foundation, on the ground that "the sale was made at so nearly a nominal sum that there is reason to believe that this Government has not faithfully observed the trust which was implied in the seizure of this property." The birth of the Foundation was the subject of much abuse in Germany, and now a resolution of the third German-American National Conference, with Mr. G. S. Viereck as chairman of the resolutions committee, declares that "we greet with satisfaction the first steps of the administration to correct the iniquities committed by the custodian of alien enemy property." Meanwhile, the consternation produced among chemists of the United States by the President's action will be readily understood.

The Chemical Foundation was established in 1919, and purchased 4,000 patents from the Alien Property Custodian for a sum of 250,000 dollars. It is a privately managed enterprise, with well-known men of high character as voting trustees, and the President, Mr. Garvan, is not salaried. The Foundation was generally commended at the time of its inception, and its affairs appear to have been conducted on altruistic principles and without profit. Non-exclusive licences have been granted in order to break monopolies and to benefit consumers; licences to the Government have been free, and on others the royalties have been low. To illustrate the beneficial effect of this policy, it has been stated that under the German monopoly the cost of salvarsan was 4.50 dollars per dose to the physician, and 2.50 dollars per dose in quantity to the Government, whereas now the price has fallen to 1.50 dollars and about 30 cents respectively.

A reasonable conclusion to draw from such evidence is that although the original price paid by the Foundation for the patents may have been "nearly a nominal sum," if regarded as a monopoly price, it was nevertheless a fair competitive price. Action is being taken by the American Chemical Society, which represents some 15,000 men and women working in educational institutions, research laboratories, and industrial plants, who regard the Chemical Foundation as the nucleus of organic chemical industry in the United States. The society, through a committee which does not include dye-makers or chemical manufacturers, is seeking a conference with President Harding for the purpose of presenting information which it believes he cannot have received before adopting such revolutionary procedure.

French Potash Information Bureau

To provide the necessary technical information in connection with the extended use of the French potash salts for agricultural and chemical purposes, and to supply the desired advice on the application of potash in conjunction with other fertilisers, the Société Commerciale des Potasses d'Alsace (The French Potash Mines of Alsace) have now established an advisory bureau in London bearing the undermentioned address:—The Agricultural Information Bureau for the French Potash Mines, Dashwood House, New Broad Street, E.C.

This bureau will supply up-to-date information dealing with the use of potash fertilisers for different crops and soils and will arrange for field demonstrations at different centres to show the fertilising value of the rich sylvinites (potash salts) obtained from the French mines. Farmers who have special manurial problems to consider are cordially invited to send their enquiries. Copies of useful publications will be supplied gratis.

The development of the French mines during the past few years has necessitated a larger organisation to make known the special fertilising value of the potash salts obtained from the Alsatian deposits. It is in the interests of both British and French agriculturists that the Alsatian mines should maintain their present position, which, despite rumours to the contrary, is entirely independent of the pre-war potash combination.

Patent Literature

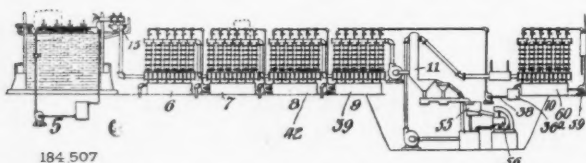
Abstracts of Complete Specifications

- 184,501. ORES, PROCESS FOR TREATING. W. J. Mellersh-Jackson, London. From Sociedad Metalurgica Chilena "Cuprum," 885, Blanco Street, Valparaiso, Chile. Application date, February 10, 1921.

The process is more particularly for preparing complex low-grade silver and gold ores for leaching, so that the metals may be more readily extracted by subsequent lixiviation. It is found that if the ore is heated in the presence of a small proportion of nitric or nitrous gases some of the minerals are rendered more soluble. The gases may be obtained by injecting into or spraying over the incandescent ore a solution of a nitrate or nitrite such as a dilute solution of ordinary commercial nitre. Alternatively, the nitrous gases may be generated outside the furnace and then brought into contact with the incandescent ore. The nitrous gases appear to have a catalytic effect in effecting the oxidation of the ore. The ores may then be lixiviated with solvents such as hot or cold water, acids, salt solutions, sodium hyposulphite, cyanide solutions, or sulphates of copper or iron. A high yield of silver and base metals is obtained by this process in treating complex argentiferous ores. Reference is directed in pursuance of Section 8, Sub-section 2 of the Patents and Designs Acts, 1907 and 1919, to Specification No. 172,356.

- 184,507. RECOVERING BY-PRODUCTS FROM DISTILLATE GASES, PROCESS AND APPARATUS FOR. A. Roberts, 208, South La Salle Street, Chicago, Ill., U.S.A. Application date, February 12, 1921.

The process is more particularly for recovering by-products from coke oven distillates. An oil or emulsion is injected into the gases to increase their vapour pressure and lower their temperature by stages, so that the by-products may be removed progressively without re-heating between the stages. Gas from a coke oven 5 passes through a main 13 to a series of condensers 6, 7, 8, 9. In the condenser 6 the upflowing gas is subjected to the action of a counter-current of an oil or emulsion at such a temperature and in such a quantity that the temperature of the gas is lowered slightly below the condensing point of the heaviest oil which it is desired to recover. For this purpose the oil which is condensed in the condenser 7 may be used. This oil has a boiling point below that of the oil recovered in the condenser 6, so that it becomes vaporised when passed into the condenser 6 and passes over



with the gas into the condenser 7. The heat extracted from the gas in condensing the heavy oil in the condenser 6 is thus absorbed in vaporising the oil received from the condenser 7. The vapour in the condensers 7 and 8 is similarly subjected to cooling and condensation by means of the oils from the condensers 8 and 9 respectively. It is thus possible to recover the various constituents from the gas without diluting it with any other substance which it is not desired to recover. When it is desired to recover ammonia by absorption in sulphuric acid, the temperature of the gas should be below that required for the condensation of all other constituents except benzol, so that the saturator is placed between the condensers 9 and 10. The oil recovered in the condenser 10 is collected in the vessel 36a, and is delivered by a pump through a pipe 38 into the condenser 9. Similar collecting vessels 39, 42, etc., are provided for the other condensers. The saturator 11 is constructed with a series of baffles, and the acid and gas are passed through in opposite directions. The ammonium sulphate crystals are collected in a hopper and passed to a draining table 55 and centrifugal 56. An example is given of the recovery of anthracene oil, creosote oil, carbolic oils, crude light oils and light oils, from distillate gases which are

relatively weak in carbolic oils and light oils. The gases are enriched with the lighter oils by injecting into them as they leave the oven a mixture containing carbolic oils and light oils. If the temperature of the gases leaving the oven is about 1,100° C., this temperature is reduced by the addition of the enriching mixture to about 500° C., and the gas passes into the condenser 6, where its temperature is reduced to about 280° C. by means of creosote oil from the condenser 7. Anthracene oil is thus recovered at 280°-285° C., and the creosote oil is re-evaporated and carried back to the condenser 7 at a temperature of about 280° C. A similar action takes place in the other condensers, the carbolic oils condensing at 165°-255° C., the crude light oils at 105°-165° C., and the light oils below 105° C.

- 184,527. COPPER SULPHATE, PROCESS AND APPARATUS FOR CRYSTALLISING. J. M. Dossett, 35, Foro Bonaparte, Milan, Italy. Application date, March 31, 1921.

The apparatus is for crystallising copper sulphate in very small crystals known as "snow" or "sand" crystals. A solution of copper sulphate is placed in a cylindrical vessel of smooth enamelled metal, which is placed in an outer vessel forming a water jacket around the sides and bottom of the crystallising vessel. The cooling surface may be increased by diametral tubes extending through the crystallising vessel and communicating with the water jacket. The solution is rapidly cooled by the water jacket, and simultaneously agitated by compressed air forced into it or by a stirring device. The sulphate is then deposited in the form of very small crystals.

- 184,533. VISCOSE, MANUFACTURE AND TREATMENT OF. Plauson's (Parent Co.), Ltd., 17, Waterloo Place, London, S.W.1. From H. Plauson, 14, Huxter, Hamburg, Germany. Application date, April 11, 1921.

In the usual process for the manufacture of viscose, the cellulose material is treated with a considerable excess of alkali and then with carbon bisulphide to form a cellulose xanthate. In the manufacture of artificial silk, it is desirable to obtain the mono-sodium viscose in preference to the disodium viscose, but this necessitates the preliminary treatment of the viscose with dilute acids at a high temperature, which results in the contamination of the product with over-hydrated cellulose and salts such as sodium sulphide, sodium thiocarbonate, esters of dithiocarbonic acid, etc. In the present process these disadvantages are avoided by transforming the raw cellulose material into a colloidal condition in a colloid mill as described in Specification No. 155,836 (see THE CHEMICAL AGE, Vol. IV., p. 313) in the presence of a suitable liquid dispersion medium, preferably the theoretical quantity of alkali required. In these circumstances, the cellulose and alkali readily combine to form alkali cellulose which may be treated with carbon bisulphide in the same apparatus. The resulting viscose possesses the property that it can be dried to a water-soluble powder, and is a reversible colloid. The viscose powder gradually becomes irreversible, but this may be avoided by keeping it in an atmosphere of nitrogen or hydrogen, or *in vacuo*. This process requires less alkali and carbon bisulphide, and less time for the reaction. The resulting viscose is pure and does not require ripening.

- 184,534. COMPOSITIONS OF OILS OR OTHER ORGANIC SUBSTANCES, MANUFACTURE OF. Plauson's (Parent Co.), Ltd., 17, Waterloo Place, London, S.W.1. (From H. Plauson, 14, Huxter, Hamburg, Germany.) Application date, April 11, 1921.

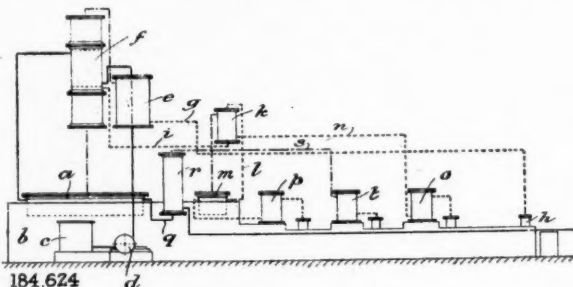
Essential oils used in the preparation of perfumes, medicines, etc., are usually dissolved in alcohol, but in the present invention, the solvent is dispensed with. The oil is transformed into a highly dispersed colloidal state by mechanical disintegration with a large quantity of water or other immiscible liquid such as glycerine, in a colloid mill such as described in specification 155,836 (see THE CHEMICAL AGE, Vol. IV., p. 313). The dispersion is assisted by the addition of substances such as ketones, alcohols, esters, etc., in very small quantity. The resulting colloidal dispersions are stable and transparent.

- 184,610. HYDRA-OXY-CELLULOSE, A NEW XANTHOGENATED COMPOUND OBTAINED THEREFROM, AND A NEW SOLID MATERIAL OBTAINED BY COAGULATION OF THE LATTER, MANUFACTURE OF. C. C. L. G. Budde, 9, Belford Terrace, Sunderland. Application date, May 28, 1921.

A new product is produced from cellulose by mixing it with a regulated quantity of water and treating it with gaseous chlorine in excess of the quantity necessary to saturate the water, and then with strong hydrochloric acid. The quantity of water used is not more than twice the weight of the cellulose, and the quantity of chlorine about 10 per cent. of that of the cellulose. The chlorinated pulp is then air-dried so that the hydrochloric acid produced in the reaction is concentrated and reacts with the oxy-cellulose to produce hydra-oxy-cellulose. The hydra-oxy-cellulose may then be xanthogenated by mixing with an 18 per cent. solution of caustic soda, and then treating with carbon bisulphide for about four hours. The product is liquid and is soluble in water forming a solution which may be used for the manufacture of artificial silk, etc. The solution may be mixed with fillers such as zinc oxide, chromic oxide, ferric oxide, clay, starch, paper pulp, dissolved resins, esparto resin, fats, waxes, glycerine, dissolved shellac, dyes, or pigments, for the manufacture of moulded articles. The product may be waterproofed by heating to 100° C.

- 184,624. TAR, DISTILLATION OF. Thermal Industrial and Chemical (T.I.C.) Research Co., Ltd., J. S. Morgan and D. Rider, 52, Grosvenor Gardens, London, S.W.1. Application dates, June 7, and December 20, 1921.

The crude tar is preheated and then distilled by passing it under the surface of molten metal, which vaporises the water and all the oils boiling below 350° C. The oils may be re-distilled without frothing or leaving a pitch residue. The tar is forced from a container *c* by a pump *d* through a heat exchanger *e* and then through the jacket of a fractionating column *f* to a still *a* which consists of a bath of molten lead which is maintained at about 275°–290° C. The vapour



passes into the fractionating column *f*, which is kept at 120° C.; and the water vapour and light oils leaving the column pass through the heat exchanger *e* and pipe *g* to the condenser *h*. The condensate from the column *f* passes through a pipe *i*, heat exchanger *h* and pipe *l* to another still *m* consisting of molten lead at a temperature of 230° C. The vapour passes from the still *m* through the heat exchanger *h* and pipe *n* to a condenser *o*, and the residue passes to a cooler *p*. The semi-pitch passes from the still *a* to a tower *r*, where it is heated with super-heated steam, and the resulting mixture of anthracene and steam passes by a pipe *s* to a condenser *t* at 100° to 104° C. to condense the anthracene.

- 184,625. DI-ALKYL AMIDES OF NICOTINIC ACID, MANUFACTURE OF. O. Y. Imray, London. From the Society of Chemical Industry in Basle, Switzerland. Application date, June 7, 1921.

Nicotinic acid or a halide or an ester is treated with a dialkyl amine to produce the corresponding dialkylamide. An example is given of the production of the di-ethyl amide of nicotinic acid (boiling point 280° C.) by heating nicotinic acid chloride with the equivalent quantity of di-ethyl amine hydrochloride for two hours at 160° C. Examples are also given of the production of the dipropyl amide of nicotinic acid,

and the piperidine of nicotinic acid. These products are used for therapeutic purposes.

- 184,627. OXALIC ACID, PRODUCTION OF. J. Y. Johnson, London. From Badische Anilin and Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Application date, June 7, 1921.

Oxalic acid is obtained by treating a cellulosic material such as wood with nitric acid, or nitric oxides and water, in the presence of a catalytic agent such as an iron compound. The wood is saturated with a 40–65 per cent. solution of nitric acid containing about 2–4 per cent. of iron in the form of nitrate, and then treated with nitrous gases of 5–10 per cent. strength at about 60° C., obtained by the catalytic oxidation of ammonia. The product is filtered and the oxalic acid, which is the main product of the oxidation, is obtained by crystallising from the filtrate. The mother liquor is used for treating a fresh quantity of wood. If nitric acid of a higher strength is used, the nitrous gases may be omitted. The escaping gases containing nitrogen oxides may be absorbed in water to produce nitric acid, which is used again. Other suitable catalysts are compounds of rare earths such as commercial didymium nitrate or didymium-lanthanum salts. Magnesium nitrate may also be used as a catalyst, and also as the oxidising agent. In this case the magnesium nitrate is fused, and wood added gradually so that the temperature does not rise above 180° C. The fused mass may be dissolved in dilute nitric or hydrochloric acid, and the oxalic acid precipitated from the solution as calcium oxalate by means of lime. The oxalic acid is obtained from the calcium oxalate in the usual manner, and the magnesium salt evaporated and used again. The oxalic acid may also be obtained directly by dissolving the fused mixture in 30 per cent. nitric acid, filtering, and cooling to 0° C., when the oxalic acid crystallises.

- 184,628. ARGENTIFEROUS LEAD-ZINC SULPHIDE ORES, TREATMENT OF. F. E. Elmore, Three Fields, Boxmoor, Herts, and The Chemical and Metallurgical Corporation, Ltd., 701, Salisbury House, London, E.C.2. Application date, June 8, 1921.

Specification No. 151,698 (see THE CHEMICAL AGE, Vol. III., p. 517) describes a process for treating argentiferous lead-zinc sulphide ores and concentrates by heating the ore to 500°–600° C. for a short time, and then treating it by the "acid-brine" process and leaching the residue to extract the silver. It is now found that an increased proportion of the silver is dissolved by the brine if sulphuretted hydrogen is removed from the mixture when the extraction of lead is nearly complete and the hot brine is still in contact with the residue. The sulphuretted hydrogen is preferably removed by passing sulphur dioxide through the mixture in the last one or two vessels in a continuous plant. The sulphur dioxide may be obtained from the sulphuretted hydrogen liberated in the first stages of the treatment with the acid brine. The zinciferous residue still contains some silver which may be recovered by treating with a fresh quantity of strongly acid brine.

- 184,671. CELLULOSE DERIVATIVES, MANUFACTURE OF SOLUTIONS, COMPOSITIONS, ETC., OF. H. Dreyfus, 8, Waterloo Place, London, S.W.1. Application date, July 20, 1921.

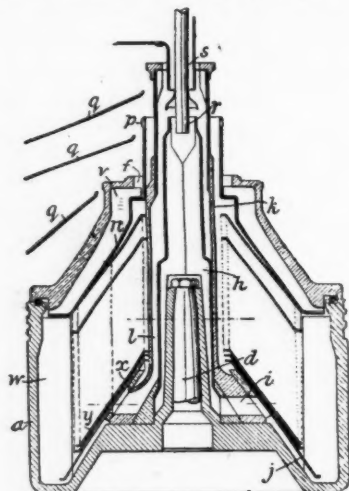
A new solvent for cellulose acetates for the manufacture of solutions, varnishes, artificial silk, etc., consists of cyclobutanone or side chain homologues such as dimethyl or diethyl cyclobutanone. Other diluents or solvents may also be used such as methyl or ethyl alcohol, acetone, methyl acetate, alcohol-benzol, etc.

NOTE.—Abstracts of the following specifications which are now accepted appeared in THE CHEMICAL AGE when they became open to inspection under the International Convention:—165,071 (Elektrizitäts Akt.-Ges. vorm. Schuckert and Co.) relating to electrolytic cells, see Vol. V., p. 215; 165,082 (Soc. d'Electro-Chimie et d'Electro-Metallurgie) relating to production of electrolytic metallic deposits which are easily detachable, see Vol. V., p. 216; 165,085 (Soc. Anon. de Produits Chimiques Etablissements Maletta) relating to the production of acetaldehyde from acetylene, see Vol. V., p. 216.

International Specifications not yet Accepted

183,133. CENTRIFUGAL SEPARATORS. S. H. Hall, 38, Roosevelt Avenue, Poughkeepsie, N.Y., U.S.A. International Convention date, July 15, 1921.

The bowl *a* is provided with a socket in the bottom to receive the driving shaft *d*. A central feeding passage *h* has four radial channels *i* leading outwards to the lower edge of a disc *j*, and a surrounding tube *k* has passages *l* arranged alternately with the passages *i* to discharge liquid through openings *x* in the liner plates *y*. A liquid which is heavier than the liquid to be purified is supplied through the central pipe *r* and passes through the conduits *h*, *i*, to the outer wall of the rotating bowl. The liquid to be purified is supplied through the pipe *s* and



183.133

passes through the conduits *h*, *i*, to the openings in the liner plates, and thence to the discharge passage *p*. The solid materials separated from the lighter liquid pass into the heavier liquid (water, brine, etc.) and are discharged with it through the outlet *f* and received by covers *q*. Radial vanes *v*, *w* ensure the rotation of the liquid with the bowl.

183,419. DYES. National Aniline and Chemical Co., Inc., 21, Burling Slip, Manhattan, New York. (Assignees of L. C. Daniels, 75, Northland Avenue, Buffalo, N.Y., U.S.A.; and W. S. Lawrence, 535, Massachusetts Avenue, Buffalo, N.Y., U.S.A.) International Convention date, July 20, 1921.

Benzanthrone is subjected to alkali fusion in the presence of an inert diluent such as kerosene, and a reducing agent such as dextrin. The crude product is then subjected to vatting with sodium hydrosulphite, the dissolved leuco compound is separated from the insoluble residue and re-oxidized by air. The purified dibenzanthrone thus obtained gives a green dye on nitration. The insoluble residue may be nitrated to yield a grey product.

183,443. BARIUM SULPHATE AND OTHER MINERALS, PURIFYING. A. L. A. Teillard, 3, Square de Luynes, Paris. International Convention date, July 18, 1921.

Minerals such as barium sulphate are broken up and heated to about 300°C. A proportion of the substance is thereby reduced to powder and is separated from the remainder.

LATEST NOTIFICATIONS.

- 185,718. Manufacture of cellulose products from viscose solutions. Glanzfaden Akt.-Ges. September 3, 1921.
 185,728. Process for the commercial preparation of aminophenylarsinic acids. Les Etablissements Poulenc Frères. September 7, 1921.
 185,729. Manufacture of artificial manures. Gradl, J. September 3, 1921.
 185,749. Method for the application of alloys of silicon and calcium in metallurgical processes. Elektrizitätswerk Lonza. September 10, 1921.
 185,754. Copper oxide cells. Foulds, M., and Leblanc, M. September 8, 1921.
 185,757. Process of absorbing ethylene and its homologues. Farbenfabriken vorm. F. Bayer and Co. September 9, 1921.

Specifications Accepted, with Date of Application

- 167,171. Sulphurous acid and heat from the waste gases from pulp boilers, Process for recovering. Zellstofffabrik Waldhof, C. Hangleiter, and H. Clemm. August 2, 1920.
 171,096. Electric furnaces. I. J. Moltke-Hansen. November 3, 1920.
 176,770. Separation of chlorides of aluminium and potassium from mixed solutions obtained in the treatment of leucite. G. A. Blanc. March 7, 1921.
 184,454. Separation of constituents of air or other gaseous mixtures. L'Air Liquide, Soc. Anon. pour l'Etude et l'Exploitation des Procédés G. Claude. August 12, 1921.
 185,135. Gas and carbonaceous materials, Production of. J. H. Reed. February 22, 1921.
 185,137. Anthraquinone dyestuffs. F. W. Atack and C. W. Souter. February 23, 1921.
 185,440. Cracking hydrocarbons or other oils. A. A. F. M. Seigle. February 24, 1921.
 185,174. Fullers' earth, charcoal, and like purifiers of fats and fatty oils, Method for the regeneration of—and of catalysts used in hydrogenating fats and fatty oils. E. R. Bolton and E. J. Lush. May 24, 1921.
 185,179. Catalytic synthesis of ammonia, Apparatus for. L. Casale and R. Leprestre. May 24, 1921.
 185,242. Ores containing copper silicate, Treatment of. H. L. Sulman, T. J. Tapling, W. G. Perkins, and H. F. K. Picard. June 9, 1921.
 185,247. Fish and other oils, Method and apparatus for treating. V. F. Feeny (Tille Guarantee and Trust Co.). June 13, 1921.
 185,313. Tungsten carbides without free carbon, Process for the manufacture of—for use as tools and implements of all kinds. P. C. Rushen. (Akt.-Ges. B. Felder-Clement.) August 15, 1921.
 185,315. Electrical precipitation. Lodge Fume Co., Ltd. (International Precipitation Co.) August 17, 1921.
 185,320. Furnaces. W. Oehm. August 27, 1921.
 185,327. Rotary kilns. O. Faber and H. V. A. Briscoe. September 5, 1921.
 185,374. Crystalline titanium oxide, Process of producing. G. Carteret and M. Devaux. June 27, 1921.

Applications for Patents

- Atack, F. W., and Thompson, W. P. Manufacture of anthraquinone and derivatives thereof. 24753. September 13.
 Badische Anilin and Soda Fabrik and Johnson, J. Y. Manufacture and production of vat colouring matters. 25121. September 16.
 Barry, G. Aluminium paint. 24561. September 11.
 Barry, G. Aluminium alloy. 24562. September 11.
 Broadhead, R. W., and Dempster and Sons, Ltd., R. Manufacture of gas. 24961. September 15.
 Carpmael, W., and Chemische Fabriken vorm. Weiler-ter Meer. Manufacture of insecticides. 24939. September 14.
 Carpmael, W., and Farbenfabriken vorm. F. Bayer and Co.). Manufacture of intermediate products, and their application for dyeing on fibre. 25120. September 16.
 Chemical Engineering Co. (Manchester), Ltd. Processes for producing intimate mixtures of substances and obtaining chemical products therefrom. 24897. September 14.
 Durand et Huguenin Soc. Anon. Manufacture of products for dyeing, etc., textile fabrics, etc. 24602. September 11. (France, September 16, 1921.)
 Gibson, J. M., and Judson, G. R. Pipes for use when immersed in chemical liquids. 24974. September 15.
 Grace, C. J. Means for separating micaceous, siliceous, etc., material from clay. 24723. September 12.
 Parodi, P. Purifying distillation apparatus. 24702. September 12. (France, September 21, 1921.)
 Plauson, H., and Plauson's (Parent Co.), Ltd. Dyeing. 24746. September 13.
 Plauson, H., and Plauson's (Parent Co.), Ltd. Process for manufacture of alkali carbonates. 24747. September 13.
 Plauson, H., and Plauson's (Parent Co.), Ltd. Process for manufacture of alkali salts. 24748. September 13.
 Rigby, G. E. T. Cement manufacture. 25113. September 16.
 Schidrowitz, P. Manufacture of rubber. 24950. September 14.
 Spensley, J. W. Processes for producing intimate mixtures of substances and obtaining chemical products therefrom. 24897. September 14.
 Sutcliffe, E. R. Apparatus for distillation of carbonaceous substances. 24624. September 11.
 Weyman, G., and Weyman, J. E. Treatment and transportation of ammonium sulphate. 24788. September 13.
 Weyman, G., and Weyman, J. E. Drying ammonium sulphate. 24941. September 14.
 Wilkinson, R. J. Method for use of asbestos in coal, etc., mines. 24685. September 12.

Market Report and Current Prices

Our Market Report and Current Prices are exclusive to THE CHEMICAL AGE, and, being independently prepared with absolute impartiality by Messrs. R. W. Greeff & Co., Ltd., and Messrs. Chas. Page & Co., Ltd., may be accepted as authoritative. The prices given apply to fair quantities delivered ex wharf or works, except where otherwise stated. The current prices are given mainly as a guide to works managers, chemists, and chemical engineers; those interested in close variations in prices should study the market report.

LONDON, SEPTEMBER 21, 1922.

TRADE during the current week has been quietly steady, without any outstanding feature.

Orders in the main still continue for relatively small quantities, but a satisfactory feature is that these are becoming much more frequent.

Export trade has been on the quiet side, although there is some inquiry for certain markets.

General Chemicals

ACETONE is in demand, but prompt delivery cannot be given. ACID ACETIC is very firm and only in short supply. ACID CITRIC is a poor market and price is easy.

ACID FORMIC has been in poor request. Price is unchanged.

ACID LACTIC in moderate demand only and price firm.

ACID TARTARIC continues quiet and the value is inclined to droop.

BARIUM CHLORIDE is in slightly better supply, and the price is not so firm as was the case recently.

COPPER SULPHATE is featureless.

CREAM OF TARTAR in better request. Price firm.

FORMALHYDE has an improving tendency and the price is much firmer.

IRON SULPHATE is only in moderate request.

LEAD ACETATE is in active demand and price steady.

LEAD NITRATE.—Only a small business to report, without change in value.

LITHOPONE.—Very firm, with a demand for export.

MAGNESIUM CHLORIDE.—Only a moderate business has been transacted.

POTASSIUM CARBONATE has been in much better request, and supplies of some strengths are very scarce.

POTASSIUM CAUSTIC seems to have fallen off again, although value is firm.

POTASSIUM CHLORATE is in good request.

SODIUM ACETATE is in fair demand at last quoted figures.

SODIUM HYPOSULPHITE is in fair request, but there is keen competition on the part of Continental suppliers for business.

SODIUM PHOSPHATE is without change.

SODIUM PRUSSATE maintains its strong position, and near supplies are difficult to obtain.

WHITE LEAD.—Without change in value.

ZINC OXIDE has been in fair request.

ZINC SULPHATE has been a bright spot, with some fair business passing.

Coal Tar Intermediates

Business still continues to be of the hand-to-mouth variety, although there seems to be slightly more inquiry on the market.

ALPHA NAPHTHOL is in demand chiefly on export account, and is without change in value.

ALPHA NAPHTHYLAMINE continues steady, with a moderate demand.

ANILINE OIL is in small request.

BETA NAPHTHOL.—Makers maintain their figures, while re-sellers' ideas are harder.

BETA NAPHTHYLAMINE is featureless.

DIMETHYLANILINE is in fair request.

DIPHENYLAMINE.—Only a moderate business is reported, but price is firm.

"G" SALT is idle.

"H" ACID moves steadily into consumption.

NAPHTHIONIC ACID is without change in value.

NITRO BENZOL is a turn easier and business is only moderate.

PARANITRANILINE is quiet and steady.

RESORCIN.—A fair amount of business is reported.

XYLIDINE in very fair request, and price easy.

Coal Tar Products

There is little change in our market from last week.

90's BENZOL remains firm, at 2s. 1d. to 2s. 2d. per gallon on rails.

PURE BENZOL has a poor inquiry, and is quoted at 2s. 4d. per gallon on rails.

CREOSOTE OIL is steady, but the demand does not appear to be quite so insistent, and we think it possible that prices may ease in the near future. It is quoted at 5½d. to 6½d. per gallon in the North, and 6½d. to 7½d. per gallon in the South.

CRESYLIC ACID is showing signs of weakness, consequent on the impending prohibitive tariff in the United States, and is worth about 2s. 4d. per gallon on rails for the Pale quality 97/99%, while the Dark quality 95/97% is worth about 2s. to 2s. 1d. per gallon.

SOLVENT NAPHTHA is fairly steady at about 1s. 9d. per gallon on rails.

HEAVY NAPHTHA is inactive, at about 1s. 8d. per gallon on rails. NAPHTHALENE is weak, and has very little business.

PITCH.—The market remains very firm, and stocks are unusually small. Business has been done at 90s f.o.b. East Coast, and sellers are now asking 92s. 6d. East Coast, and 90s. to 92s. 6d. West Coast.

Sulphate of Ammonia

There is no change in the home trade price, but there is more inquiry for export.

Current Prices

Chemicals

	Per	£	s.	d.		£	s.	d.
Acetic anhydride.....	lb.	0	1	8	to	0	1	10
Acetone oil	ton	80	0	0	to	82	10	0
Acetone, pure.....	ton	90	0	0	to	92	0	0
Acid, Acetic, glacial, 99-100%.....	ton	67	0	0	to	68	0	0
Acetic, 80% pure.....	ton	47	0	0	to	48	0	0
Arsenic, liquid, 2000 s.g.....	ton	67	0	0	to	70	0	0
Boric, cryst.	ton	60	0	0	to	65	0	0
Carbolic, cryst. 39-40%.....	lb.	0	0	6	to	0	0	6½
Citric	lb.	0	2	2	to	0	2	3
Formic, 80%.....	ton	63	0	0	to	64	0	0
Gallic, pure.....	lb.	0	2	11	to	0	3	0
Hydrofluoric.....	lb.	0	0	7½	to	0	0	8½
Lactic, 50 vol.....	ton	40	0	0	to	43	0	0
Lactic, 60 vol.....	ton	43	0	0	to	45	0	0
Nitric, 80 Tw.....	ton	30	0	0	to	31	0	0
Oxalic	lb.	0	0	7½	to	0	0	8
Phosphoric, 1.5.....	ton	38	0	0	to	40	0	0
Pyrogallie, cryst.	lb.	0	5	9	to	0	6	0
Salicylic, Technical	lb.	0	0	10½	to	0	1	0
Salicylic, B.P.....	lb.	0	1	5	to	0	1	6
Sulphuric, 92-93%.....	ton	7	10	0	to	8	0	0
Tannic, commercial.....	lb.	0	2	3	to	0	2	9
Tartaric.....	lb.	0	1	4½	to	0	1	5
Alum, lump.....	ton	10	0	0	to	10	10	0
Alum, chrome.....	ton	28	0	0	to	29	0	0
Alumino ferric.....	ton	9	0	0	to	9	5	0
Aluminium, sulphate, 14-15%.....	ton	10	10	0	to	11	0	0
Aluminium, sulphate, 17-18%.....	ton	11	10	0	to	12	0	0
Ammonia, anhydrous	lb.	0	1	8	to	0	1	9
Ammonia, .880.....	ton	33	0	0	to	35	0	0
Ammonia, .920.....	ton	21	0	0	to	23	0	0
Ammonia, carbonate.....	lb.	0	0	4	to	0	0	4½
Ammonia, chloride.....	ton	60	0	0	to	65	0	0
Ammonia, muriate (galvanisers)	ton	35	0	0	to	37	10	0
Ammonia, nitrate (pure).....	ton	35	0	0	to	40	0	0
Ammonia, phosphate.....	ton	70	0	0	to	72	0	0
Ammonia, sulphocyanide.....	lb.	0	1	10	to	0	2	0
Amyl acetate.....	ton	175	0	0	to	185	0	0
Arsenic, white, powdered.....	ton	42	0	0	to	44	0	0
Barium, carbonate, 92-94%.....	ton	12	10	0	to	13	0	0
Barium, Chlorate.....	ton	60	0	0	to	68	0	0

	Per	£	s.	d.	£	s.	d.		Per	£	s.	d.	£	s.	d.		
Barium Chloride.....	ton	22	0	0	to	22	10	0	Tin perchloride, 33%.....	lb.	0	1	2	to	0	1	4
Nitrate.....	ton	27	10	0	to	30	0	0	Perchloride, solid.....	lb.	0	1	5	to	0	1	7
Sulphate, blanc fixe, dry.....	ton	20	10	0	to	21	0	0	Protochloride (tin crystals).....	lb.	0	1	5	to	0	1	6
Sulphate, blanc fixe, pulp.....	ton	10	5	0	to	10	10	0	Zinc chloride 102° Tw.....	ton	21	0	0	to	22	10	0
Sulphocyanide, 95%.....	lb.	0	1	0	to	0	1	3	Chloride, solid, 96-98%.....	ton	25	0	0	to	30	0	0
Bleaching powder, 35-37%.....	ton	12	0	0	to	—	—	—	Oxide, 99%.....	ton	36	0	0	to	38	0	0
Borax crystals.....	ton	29	0	0	to	33	0	0	Dust, 90%.....	ton	45	0	0	to	47	10	0
Caffein.....	lb.	0	13	0	to	0	14	0	Sulphate.....	ton	18	10	0	to	19	10	0
Calcium acetate, Brown.....	ton	9	10	0	to	10	10	0									
" " Grey.....	ton	14	10	0	to	15	0	0	Coal Tar Intermediates, &c.								
Calcium Carbide.....	ton	16	0	0	to	17	0	0	Alphanaphthol, crude.....	lb.	0	2	3	to	0	2	6
Chloride.....	ton	6	0	0	to	—	—	—	Alphanaphthol, refined.....	lb.	0	3	0	to	0	3	3
Carbon bisulphide.....	ton	50	0	0	to	52	0	0	Alphanaphthylamine.....	lb.	0	2	0	to	0	2	1
Casein technical.....	ton	47	0	0	to	55	0	0	Aniline oil, drums extra.....	lb.	0	1	0	to	0	1	1
Cerium oxalate.....	lb.	0	4	6	to	0	4	9	Aniline salts.....	lb.	0	1	0	to	0	1	1
Chromium acetate.....	lb.	0	1	1	to	0	1	3	Anthracene, 40-50%.....	unit	0	0	8½	to	0	0	9
Cobalt acetate.....	lb.	0	6	0	to	0	6	6	Benzaldehyde (free of chlorine).....	lb.	0	3	6	to	0	3	9
Oxide, black.....	lb.	0	9	6	to	0	10	0	Benzidine, base.....	lb.	0	5	3	to	0	5	6
Copper chloride.....	lb.	0	1	2	to	0	1	3	Benzidine, sulphate.....	lb.	0	5	3	to	0	5	6
Sulphate.....	ton	26	10	0	to	27	0	0	Benzoic acid.....	lb.	0	1	9	to	0	2	0
Cream Tartar, 98-100%.....	ton	108	0	0	to	110	10	0	Benzoate of soda.....	lb.	0	1	7½	to	0	1	9
Epsom salts (see Magnesium sulphate)									Benzyl chloride, technical.....	lb.	0	2	0	to	0	2	3
Formaldehyde, 40% vol.....	ton	68	10	0	to	70	0	0	Betanaphthol benzoate.....	lb.	0	5	0	to	0	5	3
Formusol (Rongalite).....	lb.	0	2	6	to	0	2	9	Betanaphthol.....	lb.	0	1	4	to	0	1	4½
Glauber salts, commercial.....	ton	5	0	0	to	5	10	0	Betanaphthylamine, technical.....	lb.	0	5	0	to	0	5	6
Glycerine, crude.....	ton	65	0	0	to	67	10	0	Croceine Acid, 100% basis.....	lb.	0	3	6	to	0	3	9
Hydrogen peroxide, 12 vols.....	gal.	0	2	5	to	0	2	6	Dichlorobenzol.....	lb.	0	0	9	to	0	0	10
Iron perchloride.....	ton	30	0	0	to	32	0	0	Diethylaniline.....	lb.	0	2	9	to	0	3	0
Iron sulphate (Copperas).....	ton	4	0	0	to	4	5	0	Dinitrobenzol.....	lb.	0	1	3	to	0	1	4
Lead acetate, white.....	ton	41	0	0	to	42	0	0	Dinitrochlorbenzol.....	lb.	0	0	11	to	0	1	0
Carbonate (White Lead).....	ton	43	0	0	to	47	0	0	Dinitronaphthalene.....	lb.	0	1	4	to	0	1	5
Nitrate.....	ton	44	10	0	to	45	0	0	Dinitrotoluol.....	lb.	0	1	5	to	0	1	6
Litharge.....	ton	35	10	0	to	36	0	0	Dinitrophenol.....	lb.	0	1	9	to	0	2	0
Lithopone, 30%.....	ton	23	10	0	to	24	0	0	Dimethylaniline.....	lb.	0	2	6	to	0	2	9
Magnesium chloride.....	ton	7	0	0	to	7	10	0	Diphenylamine.....	lb.	0	4	3	to	0	4	6
Carbonate, light.....	cwt.	2	10	0	to	2	15	0	H-Acid.....	lb.	0	6	3	to	0	6	9
Sulphate (Epsom salts com- mercial).....	ton	8	0	0	to	8	10	0	Metaphenylenediamine.....	lb.	0	4	9	to	0	5	3
Sulphate (Druggists').....	ton	13	10	0	to	14	10	0	Monochlorobenzol.....	lb.	0	0	10	to	0	1	0
Manganese, Borate, commercial.....	ton	65	0	0	to	75	0	0	Metanilic Acid.....	lb.	0	6	0	to	0	6	6½
Sulphate.....	ton	60	0	0	to	62	0	0	Metatoluylenediamine.....	lb.	0	4	6	to	0	4	9
Methyl acetone.....	ton	70	0	0	to	75	0	0	Monosulphonic Acid (2.7).....	lb.	0	5	6	to	0	6	0
Alcohol, 1% acetone.....	ton	70	10	0	to	75	0	0	Naphthionic acid, crude.....	lb.	0	3	0	to	0	3	3
Nickel sulphate, single salt.....	ton	49	0	0	to	51	0	0	Naphthionate of Soda.....	lb.	0	3	0	to	0	3	3
Ammonium sulphate, double salt.....	ton	51	0	0	to	52	0	0	Naphthylamin-di-sulphonic-acid.....	lb.	0	4	0	to	0	4	3
Potash, Caustic.....	ton	33	0	0	to	34	0	0	Neville Winther Acid.....	lb.	0	7	9	to	0	8	0
Potassium bichromate.....	lb.	0	0	6½	to	—	—	—	Nitrobenzol.....	lb.	0	0	9	to	0	0	9½
Carbonate, 90%.....	ton	31	0	0	to	33	0	0	Nitronaphthalene.....	lb.	0	1	3	to	0	1	4
Chloride, 80%.....	ton	12	0	0	to	12	10	0	Nitrotoluol.....	lb.	0	1	0	to	0	1	2
Chlorate.....	lb.	0	0	4½	to	0	0	5	Orthoamidophenol, base.....	lb.	0	12	0	to	0	12	6
Metabisulphite, 50-52%.....	ton	84	0	0	to	90	0	0	Orthodichlorobenzol.....	lb.	0	1	0	to	0	1	1
Nitrate, refined.....	ton	45	0	0	to	47	0	0	Orthotoluidine.....	lb.	0	1	6	to	0	1	9
Permanganate.....	lb.	0	0	9	to	0	0	10	Orthonitrotoluol.....	lb.	0	0	8	to	0	0	10
Prussiate, red.....	lb.	0	4	6	to	0	4	9	Para-amidophenol, base.....	lb.	0	9	0	to	0	9	6
Prussiate, yellow.....	lb.	0	1	7	to	0	1	8	Para-amidophenol, hydrochlor.....	lb.	0	8	6	to	0	9	0
Sulphate, 90%.....	ton	13	0	0	to	13	10	0	Paradichlorobenzol.....	lb.	0	0	6	to	0	0	7
Salammoniac, firsts.....	cwt.	3	3	0	to	—	—	—	Paranitraniline.....	lb.	0	3	6	to	0	3	9
Seconds.....	cwt.	3	0	0	to	—	—	—	Paranitrophenol.....	lb.	0	2	3	to	0	2	6
Sodium acetate.....	ton	24	10	0	to	24	15	0	Paranitrotoluol.....	lb.	0	5	0	to	0	5	3
Arseniate, 45%.....	ton	45	0	0	to	48	0	0	Paraphenylenediamine, distilled.....	lb.	0	10	6	to	0	10	9
Bicarbonate.....	ton	10	10	0	to	11	0	0	Paratoluidine.....	lb.	0	6	0	to	0	6	6
Bichromate.....	lb.	0	0	5	to	—	—	—	Phthalic anhydride.....	lb.	0	2	9	to	0	3	0
Bisulphite, 60-62%.....	ton	23	0	0	to	24	0	0	Resorcin, technical.....	lb.	0	4	6	to	0	5	0
Chlorate.....	lb.	0	0	3½	to	0	0	4	Resorcin, pure.....	lb.	0	6	9	to	0	7	0
Caustic, 70%.....	ton	20	10	0	to	21	0	0	Salol.....	lb.	0	2	0	to	0	2	3
Caustic, 76%.....	ton	21	10	0	to	22	10	0	Sulphanilic acid, crude.....	lb.	0	1	0	to	0	1	1
Hydrosulphite, powder, 85%.....	lb.	0	1	9	to	0	2	0	Tolidine, base.....	lb.	0	6	6	to	0	7	0
Hyposulphite, commercial.....	ton	12	10	0	to	13	10	0	Tolidine, mixture.....	lb.	0	2	6	to	0	2	9
Nitrite, 96-98%.....	ton	29	10	0	to	30	0	0									
Phosphate, crystal.....	ton	16	10	0	to	17	0	0	German Chemical Trade								
Perborate.....	lb.	0	0	11	to	0	1	0	A BERLIN correspondent writes that there was a slightly								
Prussiate.....	lb.	0	0	11½	to	0	1	0	better demand for some general chemicals last week, but as a								
Sulphide, crystals.....	ton	12	10	0	to	13	10	0	whole the market is confined to small returns and does not								
Sulphide, solid, 60-62%.....	ton	21	10	0	to	23	10	0	show any sign of expansion. Hand-to-mouth purchasing is								
Sulphite, cryst.....	ton	12	10	0	to	13	0	0	still favoured by consumers.								
Strontium carbonate.....	ton	55	0	0	to	60	0	0									
Strontium Nitrate.....	ton	50	0	0	to	55	0	0									
Strontium Sulphate, white.....	ton	6	10	0	to	7	10	0									
Sulphur chloride.....	ton	25	0	0	to	27	10	0									
Sulphur, Flowers.....	ton	13	0	0	to	14	0	0									
Roll.....	ton	13	0	0	to	14	0	0									
Tartar emetic.....	lb.	0	1	5	to	0	1	6									
Theobromine.....	lb.	0	12	6	to	0	13	0									

Scottish Chemical Market

The following notes on the Scottish Chemical Market are specially supplied to THE CHEMICAL AGE by Messrs. Charles Tennant and Co., Ltd., Glasgow, and may be accepted as representing the firm's independent and impartial opinions.

GLASGOW, SEPTEMBER 20, 1922.

THE position in the chemical market shows little or no change. Prices are fairly steady, but there is nothing of importance to record.

Industrial Chemicals

ACID ACETIC.—In fairly steady demand. Glacial 98/100 per cent., £58 to £64 per ton; 80 per cent. technical, £39 to £40; 80 per cent. pure, £44 to £45 per ton.

ACID BORACIC.—Price unchanged. Crystal or granulated, £60 per ton; powdered, £62 per ton.

ACID CARBOLIC CRYSTALS.—Quoted 6½d. per lb.

ACID HYDROCHLORIC.—Makers' prices unchanged. 6s. 6d. per carboy.

ACID OXALIC.—Now quoted 7½d. per lb.

ACID SULPHURIC.—Makers' prices unchanged. 144°, £4 per ton; 168°, £7 5s. per ton; de-arsenicated, £1 per ton more.

ACID TARTARIC.—Offered at 1s. 4½d. per lb. Spot delivery.

ALUM, LUMP POTASH.—Quoted £15 per ton, ex station. Offers of £12 5s., c.i.f. U.K.

AMMONIA CARBONATE.—Price unchanged. Lump, 4d. per lb.; powder, 4½d. per lb., delivered.

AMMONIA LIQUID 880°.—On offer at 3d. per lb., ex works.

AMMONIA MURIATE GALVANIZERS.—Grey, £35 to £36 per ton; offered at £26 per ton, c.i.f. U.K. Fine white crystals, £25 per ton, c.i.f. U.K.

AMMONIA SULPHATE.—25½ per cent., £14 15s.; 25¾ per cent., £15 18s. per ton, ex works, September/October.

ARSENIC, WHITE POWDERED.—Remains about £45 to £46 per ton, ex quay.

BARIUM CHLORIDE.—Fine white 98/100 per cent. offered at £19 per ton, c.i.f. prompt.

BARYTES.—Finest white English material unchanged at £5 5s., ex works.

BLEACHING POWDER.—Price for spot lots £12 15s. per ton, ex station.

BORAX.—Crystal or granulated, £29 per ton; powdered, £30 per ton.

CALCIUM CHLORIDE.—English made £6 per ton, ex quay or station.

COPPERAS, GREEN.—£3 15s. to £4 per ton, ex works.

GLAUBER SALTS.—Price £4 to £5 per ton, according to quality. LEAD.—No change in price. Red lead, £37 15s.; white lead, £49 15s. per ton, delivered minimum 5 ton lots.

MAGNESITE.—In little demand. Finest Eubœan offered at £9 per ton, c.i.f. U.K. Spot lots about £11 to £12 per ton.

MAGNESIUM CHLORIDE.—Spot parcels offered at £6 per ton, ex store.

MAGNESIUM SULPHATE (EPSOM SALTS).—Commercial, £7 5s. per ton; B.P., £9 10s. per ton.

POTASSIUM BICARBONATE.—English makers' price unchanged at 6½d. delivered.

POTASSIUM CARBONATE.—96/98 % quoted £32 per ton; 90/92 % £28 10s. per ton ex store; spot 90/92 % offered at £25 c.i.f. U.K.

POTASSIUM CAUSTIC.—88/92 %.—Spot lots offered at £30 per ton ex store.

POTASSIUM CHLORATE.—Price about 4½d. per lb. ex store.

POTASSIUM NITRATE (SALTPETRE).—Quoted £24 per ton c.i.f. U.K. prompt.

POTASSIUM PRUSSATE.—Yellow about 1s. 8d. per lb. ex store.

SODIUM BICARBONATE.—Refined quality £10 10s. per ton ex quay or station. M.W. quality £1 per ton less.

SODIUM BICHRONATE.—English make 5d. per lb. delivered.

SODIUM CARBONATE (SODA CRYSTALS).—£5 10s. to £5 15s. per ton ex quay or station.

SODIUM ALKALI, 58 %.—£9 1s. 6d. per ton ex quay, spot delivery.

SODIUM CAUSTIC.—76/77 % £23 5s. per ton; 70/72 %, £21 5s. per ton; 60 %, Broken, £24 per ton. Powdered, 98/99 %, £26 15s. to £27 15s. per ton. Moderate demand for export.

SODIUM HYPOSULPHITE.—Commercial about £13 per ton. Pea Crystals, £18 per ton ex station.

SODIUM NITRATE.—Refined quality, 96/98 %, £12 15s. per ton f.o.r. or f.o.b.

SODIUM NITRITE.—100 % Moderate inquiry, £30 per ton delivered.

SODIUM SILICATE, 140°.—Price, £11 per ton f.o.b. U.K.

SODIUM SULPHATE (SALTCAKE 95 %).—A few inquiries for export, £4 10s. to £5 f.o.b.

SODIUM SULPHIDE, 60/62 % CONC.—Offered at £16 per ton c.i.f.; 30/32 % Crystals about £8 10s. c.i.f.

SULPHUR.—Government surplus stock of Sicilian Thirds, £4 5s. to £4 15s. ex depot; flowers, £13.

SULPHUR.—Roll, £12; ground, £11; rock, £11. Prices nominal. Very little inquiry.

TIN CRYSTALS.—Price unchanged, 1s. 2d. per lb.

ZINC CHLORIDE.—Quoted £22 per ton ex quay.

NOTE.—The above prices are for bulk, and are not to be taken as applicable to small parcels.

Coal Tar Intermediates and Wood Distillation Products

ALPHA NAPHTHOL.—Home inquiry. Price quoted, 2s. 9d. per lb. carriage paid.

BENZOL, 90'S AND PURE.—Cheap supplies are offered from America.

DI-ETHYL-ANILINE.—Export inquiry. Price quoted, 4s. 7d. per lb., f.o.b., drums included.

DIMETHYLANILINE.—Supplies are offered at 2s. 6d. per lb. delivered.

GAMMA ACID.—Home inquiry. Price quoted, 13s. 9d. per lb. on 100 % basis delivered.

"H" ACID.—Supplies are now offered at about 6s. per lb.

PARA XYLYDINE.—Export inquiry. Price quoted, 8s. 3d. per lb. f.o.b. U.K. port.

TOLIDINE BASE.—Home inquiry. Price quoted, 7s. per lb. on 100 % basis delivered.

TOLUOL PURE.—Supplies are offered at 2s. 6d. per gallon delivered.

Mr. Lennox Lee on Chemical Industry

MR. Lennox Lee, chairman of the Calico Printers' Association, at the annual meeting in Manchester on Wednesday, referred to the Lord Chancellor's recent pamphlet in support of the Dyestuffs Act. The Lord Chancellor, he said, by contrasting the imports of chemicals into the United Kingdom with the exports of chemicals from Germany and giving no other figures, in effect, suggested that Great Britain's chemical business with the world was limited to importation and Germany's to exportation, and further implied that we were entirely dependent for all our chemicals on which Germany sold us. The plain truth was, as Lord Birkenhead ought to know, that this country had long had a huge and varied chemical industry competing with all the world, and that the existence of this industry enabled us at comparatively short notice to produce during the war, poison gases even superior to those produced by the Germans, after long and careful preparations.

U.S.A. Tariff Bill

THE United States House of Representatives decided last week by 177 votes to 130 to send the Fordney Tariff Bill back to the joint committee of both Houses with instructions to eliminate the dye embargo and the sections dealing with potash, and the joint committee has complied with the request. The result is to place potash on the free list and to subject imported dyestuffs to a duty of 7 cents per lb., plus 60 per cent. *ad valorem*, to be slightly reduced after two years.

The Tariff Bill was passed on Tuesday, after occupying the attention of Congress for twenty months. The Bill provides that the new duties shall become effective the day following its enactment, and importers are making exceptional efforts to withdraw merchandise from the Customs warehouses under the old rates.

Later information from Washington states that the House Committee of Ways and Means has decided to extend for three months the present embargo on chemical dyes.

Importance of Liquid Fuel

The Experiments of Dr. Bergius

THE importance to this country of a supply of liquid fuel was emphasised in the engineering section of the British Association at Hull. Dr. C. H. LANDER read a statement, prepared by the Fuel Research Board, on home-produced oil fuel. It was pointed out that during the past fifteen years a complete substitution of coal by oil fuel in the Navy had been effected. In the mercantile marine development had taken place at a slower rate, but during the year 1920-21 58 per cent. of the new vessels classed under Lloyd's register were fitted for burning oil fuel. The natural source of fuel in this country was, of course, coal, followed at a considerable distance by peat and oil shale. Regarding the latter it was improbable that under present conditions the output of Scottish shale oils could be increased by an amount which would have an appreciable bearing on the problem. We were forced, then, to regard coal as the only source from which it would be possible to produce a sufficient quantity of liquid fuel to meet our maritime requirements. Since the greater part of the heat units present in the original coal appeared in the metallurgical coke it formed an excellent and absolutely smokeless fuel, and it was necessary for the commercial success of the process that domestic consumers should recognise its superiority to raw coal in the household grate, and that it should be widely adopted by those who were willing to pay a price slightly in excess of that charged for the household coal which it would replace. Results of an investigation of the oil produced at East Greenwich by the distillation of coal in shallow trays, in horizontal retorts, showed that from 12 to 18 gallons of oil were obtained per ton of dry coal. After discussing the suitability of this oil for steam raising, Dr. Lander said that the work of Dr. Bergius in Germany on the hydrogenation of heavy oils and tars, and even on bituminous coal, had opened up new possibilities in the production of liquid fuels from coal. It was claimed that in that way the yields of petrol, diesel oil, and fuel oil from coal could be enormously increased. He mentioned that Dr. Bergius had actually succeeded in liquefying coal and in introducing oil into the coal to combine with the coal and produce the oil. If those claims could be substantiated the consequences would be of far-reaching importance.

German Drug Factory Fire

THE chemical factory of the firm of E. Merck, of Darmstadt, well known for its output of medicinal preparations, cocaine, opium and so forth, caught fire early on Friday morning, September 15th. It was not before noon that the flames were got under control, and by that time a large part of the factory buildings lay in ruins.

The factory was composed of a central building, known as the Drugs House, and two flanking wings all five storeys high. The Drugs House was the storage for vast quantities of dried tropical plants, the raw material of the factory, and in the same building was a great deal of special machinery, as well as the experimental and testing laboratories.

The dried plants blazed up rapidly as the fire spread, and the fire brigade from Darmstadt was quite unable to prevent its spreading to the whole building. Their efforts were augmented by the arrival of other fire brigades from the surrounding district, and over one hundred hose pipes were soon playing upon the fire. It was soon evident, however, that the central building could not be saved, and efforts were concentrated on preventing the flames and sparks from setting fire to the wings. In this the firemen were successful.

The workmen of the day shift, who began to arrive at the factory before half-past seven, were organised by the firemen into a salvage corps, in order that at least a part of the stores of tropical plants might be saved. One of the witnesses described the great courage displayed by these men, thanks to whom the entire stock of opium was loaded on to carts, motor-cars, and trucks, and got out of the reach of the flames. In this way also a mass of other valuable material was saved before the roof fell in and the walls collapsed. One of the firemen was dangerously, and another slightly, injured.

The damage cannot at present be exactly estimated. The proprietors hope to resume manufacture in a brief while, and will in the meantime employ the men on the work of clearing and other work.

The Key Industries Act

Difficulties of China and Glassware Trade

THE Vigilance Committee of the London Chamber of Commerce are investigating certain facts brought to their notice by the china and glassware and the fancy goods sections of the Chamber, which, they are informed, indicate that further difficulties are arising in connection with the administration of the Safeguarding of Industries Act. It is stated that a fresh crop of difficulties is occurring in connection with the recent Orders made by the Board of Trade under the Act, especially in connection with the Order imposing a duty on domestic hollow-ware and glassware. Ordinary vacuum flasks are not dutiable under the Act, it is pointed out, but it is found that many of them contain a small hollow aluminium cup. As this is domestic hollow-ware, the flasks are being detained for payment of a duty of one penny on each. The idea was entertained that immense quantities of enamelled hollow-ware were coming in from Germany, but it is now found that German imports are very small, and that the goods are imported from Silesia, which has now become part of Poland. The Safeguarding of Industries Act, it is declared, has missed fire.

The Domestic Glassware Order is said to have given rise to many difficulties. Oil lamp chimneys were supposed to be exempt. In fact, however, consignments have been held up for periods of many days. Hurricane oil lamps are not being given the benefit of the exemption. The Customs claim that the glassware they contain comes under the heading of "globes." While the Orders are only supposed to affect German goods, British importers are now required to produce certificates of origin for goods that come from any part of Europe. British consulates abroad charge 12s. 6d. for each certificate, compared with the charge for certificates of origin for British goods exported from London of 2s. 6d. each. Indignation exists among merchants at what they consider to be an exorbitant charge made by the consulates abroad.

A New Colour Index

THE first instalment of the new Colour Index has been issued by the Society of Dyers and Colourists of Bradford, under the editorship of Dr. F. M. Rowe, of the Manchester College of Technology, assisted by Mr. C. Lea and a large revision committee on which the leading dyestuff manufacturers and dyestuff users of all classes are represented. Amongst others who have helped forward the production are Professors A. G. Perkin (Leeds), G. T. Morgan (Birmingham), and Knecht (Manchester). One hundred and fifty copies of the proofs have also been revised by colour manufacturers everywhere, with the exception of Germany.

"We used every possible means to persuade Germany to come in, too," states Dr. Rowe, "but, apparently after a meeting of all their dyestuffs manufacturers, they refused. It may be remembered that Schultz's 'Farbstofftabellen,' which the Index is intended to replace, was regarded as such an important book that when it was scarce, during the war, the Americans made a photographic copy of it and circulated it throughout the United States. The 1914 Schultz purported to include by name all the commercially made dyestuffs of which the constituents, method of preparation and properties were public knowledge. Since 1914 the whole situation has, of course, altered. Many firms are now placing on the market dyes which may not be new but at least have completely new names, and one of the points of the Colour Index is to include all the alternative trade names under which the dye is marketed attached to the particular composition of the actual chemicals concerned. We have brought up-to-date all the scientific and patent literature references and made them as complete as possible. It has taken us a year to get out the first part, but meanwhile sufficient matter for ten parts has been prepared for the printer. All told, there will be full particulars of about 1,400 individual colours, or 400 more than in the last edition of Schultz, and quite a large number of dyes which have never figured before in a work of this kind will be included." The dyes dealt with are those manufactured by more than 100 makers all over the world. Belgium, Holland, Spain, Russia and Czecho-Slovakia are represented by one firm apiece, and other countries in their order are:—Japan, 2; Italy, 2; Switzerland, 5; France, 17; United States, 29; Germany, 32; Great Britain, 32.

Government Chemist's Report

DURING the year ended March 31 last the Chief Government Chemist reports that 302,562 samples were dealt with at the Government Laboratory, a decrease of 6,113 on the previous year. The most notable addition to the work of the department during the year was in connection with the Safeguarding of Industries Act, 3,000 samples being received in six months. A large part of the work of the laboratory is done in connection with the Customs for the assessment of various articles to duty. A great number of samples of beer was examined, in certain cases in order to ascertain whether dilution had taken place. For this purpose 4,650 samples were taken from the premises of publicans and other retailers, as compared with 854 in 1921. In 211 instances there was evidence of dilution, and in 26 cases the dilution was equivalent to the addition of over four gallons of water per barrel. The import of beer practically ceased during the war, and the quantity at present imported is still insignificant compared with pre-war times. The number of samples examined in the year was only 702, as against nearly 10,000 in the year ending March 31, 1914. Twenty-nine samples of spirits and other materials relating to six cases of illicit distillation were examined, and with one exception evidence was obtained that the spirits were the product of illicit distillation. A great increase has taken place in the number of samples of tea examined as compared with pre-war days. This is chiefly due to the greater variability of the tea imported. The higher price of tea and the dislocation of foreign markets, especially in Central Europe, have resulted in the importation of numerous small shipments of tea in the form of dust or otherwise doubtful quality. In addition considerable shipments were stored during the war in ports in the Far East under conditions which in many cases resulted in serious deterioration.

For the Board of Agriculture a large number of samples of foodstuffs were examined, and for the Disposal Board 300 milligrams of radium bromide were recovered. The activities of the laboratory also extended to such matters as an analysis of the fluids used for fire-extinguishing appliances and the gum used on stamps. A cleansing powder for sanitary purposes, which was examined for the Office of Works, was found to consist of material costing about 5s. per cwt., although, it is said, extraordinary prices were asked for the article submitted for analysis.

Chemists' Exhibition in Leeds

THE Chemists' Exhibition, usually held in London, is this taking place in Leeds, members of the trade in the North having expressed a desire to have greater facilities for inspecting the latest developments in their line of business. The exhibition is primarily for members of the trade, and it is organised by *The British and Colonial Pharmacist*. Leeds was chosen as being one of the best centres for the Northern area, and the fifty stalls, attractively laid out in the Town Hall, Leeds, contain a very varied selection of goods supplied by the chemist, not only drugs and patent foods, but toilet requisites, perfumes, plasters, nursing and nursery requirements, disinfectants, medicated wines, optical instruments, photographic goods, ointments, etc. The exhibitors are, for the most part, well-known firms from London and other parts of the country, and the exhibition provides evidence of a world trade by the North-Country houses. In a word, the exhibition contains the latest things in drugs and druggists' wares.

The exhibition was formally opened by Mr. F. Pilkington Sargeant, of Leeds, vice-president of the Pharmaceutical Society of Great Britain, who said it was the policy of that society that there should be an efficient pharmaceutical service in this country. To that end there must be administrative activity on the part of the society, and educational and technical equipment on the part of the retailer. Two great factors tended to-day to produce an efficient service: first, the standard of purity maintained by British manufacturers; and, secondly, the standard of accuracy obtained by the wholesalers and distributors. In order that that service might be as perfect as possible, there must be the closest co-ordination between the manufacturer, the wholesaler, and the retailer.

Company News

SHAWINIGAN WATER AND POWER.—Dividend of 1½ per cent. on the common stock for the quarter ending September 30, payable on October 10.

ELECTROLYTIC ZINC CO.—In pursuance of the intimation contained in the circular issued in July last to preference shareholders of the Electrolytic Zinc Co. of Australasia, Ltd., the directors have decided to make a further distribution by way of dividend on the 1,100,000 cumulative participating preference shares in the capital of the company. At a meeting of the Board of Directors held on September 19 a dividend of 7'41696d. per share was declared due and payable at the registered offices of the company on December 1, 1922. This dividend represents the amount accrued on the above-mentioned issue from July 1 to December 31, 1921, inclusive. Transfer books and share registers will close at 5 p.m. on November 8, and re-open at 10 a.m. on November 10. Dividend will be payable to shareholders registered on November 9. The transfer books will close at the London office of the company at 5 p.m. on November 8, and re-open at 10 a.m. on November 10, as advised above. Warrants for the dividend due to shareholders on the London register, less tax, will be posted direct from the London office.

BROKEN HILL PROPRIETARY.—The report for the four weeks ended July 19 states that the whole of the company's plant at Newcastle was shut down, with the exception of the steel foundry, which produced during the period 17 tons of castings, production has entirely ceased. Advantage is being taken to effect various repairs and alterations. Iron Knob.—Productive operations are still suspended, and no shipments of ironstone were made to Newcastle from this source. Melrose Quarry.—No shipments of limestone were made from this quarry; operations still being suspended. Taree.—During the period under review no limestone was transported to Newcastle from this source. Broken Hill.—Underground.—Mining operations were suspended throughout the term. Ore Dressing Mills.—20,107 tons of tailings were treated, producing 302 tons of lead concentrate and 4,431 tons of slime. Zinc Separation Plant.—2,422 tons of zinc concentrate were produced by this plant, the assay value being 48·16 per cent. zinc, 4·91 per cent. lead, and 10·77 oz. silver. Slime Floatation Plant ("Bradford" Process).—1,535 tons of lead concentrate were produced from slime, assaying 15·89 per cent. zinc, 47·86 per cent. lead, 82·48 oz. silver, together with 3,516 tons of zinc concentrate, assaying 51·07 per cent. zinc, 2·87 per cent. lead, and 12·41 oz. silver. Sulphuric Acid Plant.—476 tons of strong acid were produced; no sales were made to outsiders.

Chemical Trade Inquiries

The following inquiries, abstracted from the "Board of Trade Journal," have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1. British firms may obtain the names and addresses of the inquirers by applying to the Department (quoting the reference number and country), except where otherwise stated.

LOCALITY OF FIRM OR AGENT.	MATERIAL.	REF. No.
Italy	Chemicals, colours, varnishes, soaps, perfumes, etc.	—
France and Belgium ..	Calcined magnesite, white spirit, binoxide of magnesia, muriate of ammonia, acetone, etc. ..	—

Tariff Changes

GERMANY.—A proclamation dated August 31 increases the tax on acetic acid and vinegar imported from abroad to the rate of 6,855 marks per 100 kilograms. of anhydrous acid contained therein.

FRANCE.—The French *Journal Officiel* for September 5 contains a Presidential Decree, dated September 4, which suspends the import duty of 8 frs. per 100 kilograms., increased by a "co-efficient" of 2·5, levied under the "General" Tariff on crude sulphate of ammonia (Tariff No. 019). This article was already free from duty under the "Minimum" Tariff, to which United Kingdom goods are subject.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

County Court Judgments

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.]

- ABBOTT, James (trading as the UNIVERSAL DISINFECTANT CO.), 72, Aberdeen Crescent, Edgeley, Stockport, liquid soap manufacturer. £13 17s. 11d. July 21.
- BERGIN, Mrs. (trading as LEIGHTON LABORATORY), 35, Gray's Inn Road, W.C., manufacturing chemist. £16 16s. June 20.
- DRAKE, KENDAL AND CO., LTD., 29, Seymour Place, W. chemists. £16 9s. 6d. August 2.
- LUND, W. J. AND CO., 51, Penny Street, Lancaster, chemists. £10 4s. 1d. August 9.
- MASSON SEELY AND CO., LTD., 121, Victoria Street, S.W., chemical and drug machinery engineers. £13 10s. 6d. July 25.
- PARRY, Mr. R., 123, Granby Street, Toxteth Park, Liverpool, chemist. £13 4s. 10d. August 1.
- RAWLINSON, Charles Albert Walter, 82, Dixon Street, Lincoln, chemist. £22 14s. 6d. July 26.
- STYLES, Walter P., 17, Castle Street, Beaumaris, chemist. £20 3s. 6d. July 21.

Mortgages and Charges

[NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

- BELL (JOHN) AND CROYDEN, LTD., London, W., chemists.—Registered September 6, trust deed, dated August 25, 1922, securing £125,000 debenture stock; charged on freehold and leasehold property specified in schedule to deed, also general charge. *£125,000. September 1, 1922.
- OLEINE, LTD., Leeds, oil distillers, etc.—Registered September 11, £5,500 debentures, part of £15,000; general charge. *£14,600. September 21, 1922.
- PREMIER DYEING AND FINISHING CO., LTD., Leek.—Registered August 4, £25,000 debentures secured by trust deed dated July 17, 1922, present issue £14,000; charged on Premier Works, Tittesworth, Leek and Knight Street Works, Macclesfield, also general charge. *£9,000. April 1, 1922.

Satisfactions

- PREMIER DYEING AND FINISHING CO., LTD., Leek.—Satisfaction registered August 4, £9,000, registered November 4, 1921.
- PRICES' CO., LTD., London, S.W., oil and grease manufacturers.—Satisfaction registered September 9, £138,000, registered January 7, 1913.

Deed of Arrangement

- LEWIS, Robert Alun Ellis, 45-47, High Street, Aberavon, and John Street, Porthcawl, chemist.—Filed September 15. Trustees, S. E. Clutterbuck, 31, Queen Street, Cardiff, I.A., and another. Secured creditors, £714; liabilities unsecured, £672; assets, less secured claims, £693.

London Gazette

Company Winding Up

INECTO, LTD., 15A, North Audley Street, London. First meeting at 33, Carey Street, Lincoln's Inn, London, W.C.2, on September 28; creditors at 11.30 a.m., and contributories at 12 noon.

Company Winding up Voluntarily

CAPITAL CHEMICAL CO., LTD.—H. Hackett, chartered accountant, 448, Strand, London, W.C.2, appointed liquidator. Meeting of creditors at 448, Strand, London, on Friday, September 29, at 12 noon. Particulars of claims to liquidator by October 31.

Notice of Dividend

THOMPSON, William Goulden, 25, Manchester Road, Chorlton-cum-Hardy, Manchester, aniline merchant. First and final dividend of 3s. 2½d. in the £, payable September 25, Official Receiver's Offices, Byrom Street, Manchester.

Application for Discharge

JOHNSON, Joseph Melbourne, High Street, Upton-on-Severn, Worcester, chemist. Hearing, November 22, 11 a.m., Shirehall, Worcester.

Partnership Dissolved

BULLOUGH, EVANS AND CO. (Henry BULLOUGH, and William Charles EVANS), chemical manufacturers, 46A, Market Street, Manchester, and 27, Cook Street, Pendleton, near Manchester, by mutual consent as and from June 24, 1922. Debts received and paid by W. C. Evans.

New Companies Registered

- GUANOGEN, LTD. (private company), 52, High Street, Birmingham. To acquire the business of fertiliser manufacturers and merchants carried on by J. A. Knight and Co., Liverpool and Birmingham; also to acquire contracts for the purchase of sludge for 21 years. Nominal capital, £12,000 in £1 shares (4,000 7½ per cent. preference).
- HARRISON, GARDNER AND CO., LTD. (private company), Victoria Dye Works, Liversedge, Yorks. To carry on the business of dyers, bleachers, and finishers of yarn, etc. Nominal capital, £20,000 in £1 shares (5,000 6 per cent. cumulative preference).
- NORTH BRITISH FERTILISER CO., LTD. (private company), 19, Castle Street, Liverpool. To take over the business of the "North British Manure Co., Ltd.," Liverpool, manufacturers of chemical manure and fertilisers. Nominal capital, £10,000 in £1 shares. A director, J. A. Milestone, 4, Manor Mansions, Wallasey.
- PARADE DRUG STORES, LTD., 9 Green Lanes, Stoke Newington, N.16. Wholesale and retail chemists, druggists, drysalters, oil, paint and colour merchants, etc. Nominal capital £1,000 in £1 shares. A director: E. J. Reedman, 9 Green Lanes, N.16.
- STACEY'S CASH CHEMISTS, LTD., 409, Wandsworth Road, London, S.W. Manufacturing and dispensing chemists, druggists, drysalters, etc. Nominal capital, £500 in £1 shares.
- JAMES WHITE (WIDNES), LTD., Ditton Road, Chambers, Widnes. To acquire the business carried on at the Albert Oil and Grease Works, Widnes, as JAMES WHITE AND CO., and to deal in lubricating greases, solidified and soluble oils, aleic acid and tallow compounds, etc. Nominal capital, £30,000 in £1 shares (15,000 7½ per cent. cumulative preference and 15,000 ordinary).

Stock Exchange Record

Stock Exchange highest and lowest prices and dividends for each of the years 1912 to 1921, inclusive, are contrasted in the fourteenth issue of *Stock Exchange Ten-Year Record*, recently published by Fred C. Mathieson and Sons, 16, Copthall Avenue, E.C.2 (price 20s.). The present number is of interest as showing the course of prices for three years after the war as compared with the war period and two years before. Where par values of shares have been altered, relative prices are shown. If a review over twenty years be desired, copies of the 1912 issue can be obtained from the publishers at the same price as that now under our notice.

